

# Radio- Electronics®

SPECIAL ISSUE:  
VIDEO ELECTRONICS

\$1.50 DEC. 1983  
U.K. 85p

DGS

COMPUTERS - VIDEO - STEREO - TECHNOLOGY - SERVICE

Cover story

## VIDEO COLOR PROCESSOR

build it for your VCR

New and revolutionary!

## DIGITAL TV SETS

How they work

Build an inexpensive

## SELECTRIC ADAPTER

for letter-quality printouts

Save money!

## VCR REPAIRS

you can do yourself

How to design

## FILTER CIRCUITS

to match your needs



A  
GERNSBACK  
PUBLICATION

**PLUS:**

- ★ Hobby Corner ★ Equipment Reports
- ★ Drawing Board ★ Service Clinic
- ★ New Idea ★ State-Of-Solid-State





# We've got it all together.



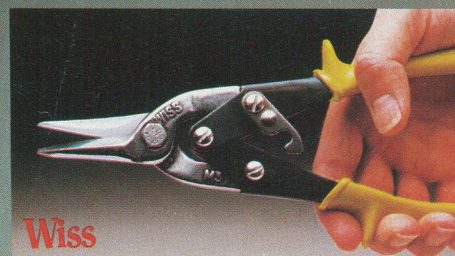
Weller



Weller



Xcelite



Wiss



Nicholson

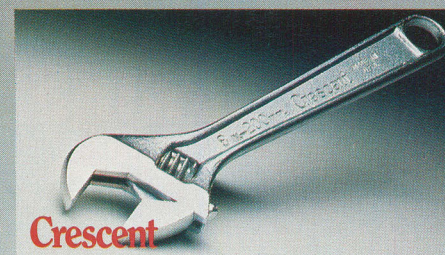


Boker

**Boker<sup>®</sup>**  
**Crescent<sup>®</sup>**  
**Lufkin<sup>®</sup>**  
**Nicholson<sup>®</sup>**  
**Plumb<sup>®</sup>**  
**Weller<sup>®</sup>, Wiss<sup>®</sup>**  
**Xcelite<sup>®</sup>**



Lufkin



Crescent



Plumb

Take a good look round this ad and you'll agree that "All together" is no exaggeration. Whether you're making or mending, cutting or joining, striking, measuring or stripping, there's a Cooper tool that's just right for the job. Don't take chances on tools. Specify Cooper and get 'em right the first time!



The Cooper Group PO Box 728 Apex NC 27502 USA Tel (919) 362-7510 Telex 579497

**CooperTools**

CIRCLE 86 ON FREE INFORMATION CARD



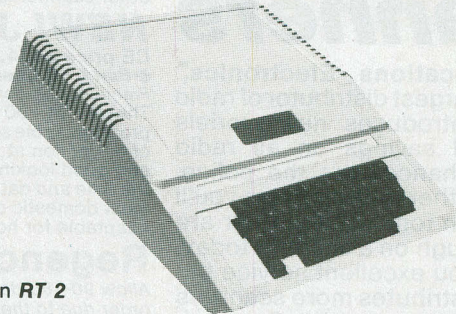
# IT'S HERE AT LAST!

THE FIRST LOW COST 6502 COMPUTER WITH 48K RAM THAT'S COMPLETELY COMPATIBLE WITH APPLE II®

Introducing the RAM-TECH® RT 2 computer which offers you greater flexibility than the Apple II+® at a price that's easier on your finances. The RT 2 will run all software and use all peripheral hardware designed for the Apple II+®. It's 100% Apple® compatible yet it offers you features not available on the Apple II+®.

## COMPARE THESE FEATURES:

- supports upper & lower case characters from the keyboard
- high quality ABS case will not crack and is light weight
- RF modulator included in addition to composite video output
- high quality light-touch keyboard with upper/lower case key
- 15 key numeric key pad for fast data entry (optional)
- high power switching power supply (8.5 amps total) will power two disk drives and several peripherals easily, has internal circuit breaker
- eight expansion slots to increase flexibility with peripheral cards
- 48K RAM expandable to 64K (192K RAM upgrade card available soon)
- socketed IC's for quick and easy service
- thousands of programs (business & home) available
- operates identically to the Apple II+® with exception of extra features on RT 2
- full 90 days parts and labor warranty with fast service turn-around



THE RAM-TECH® RT 2 IS EVERYTHING YOU ALWAYS WANTED FROM AN APPLE® (AND MORE), BUT THOUGHT YOU COULDN'T AFFORD. AND THAT'S GOOD NEWS!

### BUT THE BEST NEWS IS THE PRICE:

\$525.00 + \$18.00 shipping & handling

### WITH OPTIONAL NUMERIC KEYPAD:

\$575.00 + \$18.00 shipping & handling

COMPARED TO APPLE II® WHICH RETAILS AT MORE THAN DOUBLE THIS PRICE AND OFFERS YOU LESS, YOU CAN SEE WHY THE RAM-TECH® RT 2 SHOULD BE YOUR CHOICE. MAKE NO SYNTAX ABOUT IT, THE RT 2 IS FOR YOU!

**PERSONAL I.D. OPTION** — We will burn your name into ROM. When you power up your Ram-Tech your name will be displayed on the screen. **AN EXTRA MEASURE OF SECURITY AGAINST THEFT.**

Indicate on your order what name you wish to use (maximum 8 letters including spaces) — ADD: \$25.00 for I.D. option.

**ALSO AVAILABLE:** (sub-assemblies for do-it yourselfers) — 90 days warranty

- |  |          |
|--|----------|
| 1 — ABS case, high quality, Apple® look-a-like and color matched, will replace Apple® case.....              | \$ 68.50 |
| 2 — same as #1 above but with numeric keypad cutout.....   | \$ 84.00 |
| 3 — keyboard with upper/lower case key, direct replacement for Apple® or Ram-Tech*.....                      | \$110.00 |
| 4 — same as #3 above but with numeric keypad, use in combination with #2, also fits Apple®.....              | \$139.50 |
| 5 — RF modulator with TV switch and cable, also fits Apple®.....   | \$ 19.50 |
| 6 — switching power supply, 8.5 amps, internal circuit breaker, high power, also fits Apple®.....            | \$112.00 |
| 7 — motherboard, completely assembled & tested, fully operational with burned ROMS.....                      | \$295.00 |
| 8 — bare motherboard w/ parts discription screened on board and instructions, highest quality G10 epoxy..... | \$ 48.00 |

SHIPPING & HANDLING FOR ABOVE: cases #1 & 2 add 10%; all others add 5%

## PERIPHERALS, CARDS & ACCESSORIES FOR YOUR RAM-TECH® OR APPLE®

all items #1 to 19 guaranteed for one year (disk drives for six months)

- |  |          |                               |          |
|--|----------|-------------------------------|----------|
| 1 — 16K RAM card.....  | \$ 58.00 | 11 — interger card.....       | \$ 97.50 |
| 2 — 80 column card.....  | \$ 94.50 | 12 — PAL card.....            | \$114.00 |
| 3 — clock card.....  | \$135.00 | 13 — language card.....       | \$ 72.50 |
| 4 — communications card.....                                   | \$ 89.00 | 14 — RS-232 serial card.....  | \$ 84.00 |
| 5 — disk controller card.....                                  | \$ 58.00 | 15 — Z-80 CP/M card.....      | \$ 92.00 |
| 6 — EPROM writer card.....                                     | \$124.50 | 16 — VERSA card.....          | \$345.00 |
| 7 — FORTH card.....  | \$ 98.50 | 17 — analog/digital card..... | \$116.50 |
| 8 — IEEE-488 card w/cable.....                                 | \$186.00 | 18 — system cooling fan.....  | \$ 63.00 |
| 9 — parallel printer card w/cable.....                         | \$112.00 | 19 — joy stick w/button.....  | \$ 24.50 |
| 10 — parallel printer buffer and grappler card with cable..... |          |                               | \$245.00 |

**DISK DRIVES:** Guaranteed high quality for use with all Apple® compatible (or Ram-Tech\*) controllers — DOS 3.3 & 3.2

**USES SPECIAL LOW POWER CONSUMPTION CIRCUITRY**

- |               |          |       |                          |
|---------------|----------|-------|--------------------------|
| TEAC 55A..... | \$325.00 | ..... | \$370.00 with controller |
| SHUGART.....  | \$285.00 | ..... | \$330.00 with controller |

SHIPPING & HANDLING: add \$3.50 per item #1 - 19 . . . disk drives add \$10.00

## TO ORDER

- ALL PRICES IN U.S. CURRENCY
- VISA OR MASTER CARD: SEND NUMBER, EXPIRY DATE, BANK NAME & CARD HOLDER'S NAME, INCLUDE PHONE NUMBER.
- CHECKS & MONEY ORDERS O.K. — CHECKS NEED THREE WEEKS TO CLEAR. (NO C.O.D.'S TO U.S. DUE TO POSTAL REGULATIONS)
- CANADIAN ORDERS ADD 25% FOR CDN FUNDS EXCHANGE.
- U.S. CUSTOMERS WILL HAVE TO PAY U.S. CUSTOMS 4.7% DUTY. DUTIES COLLECTED BY POST OFFICE.
- WE ASSUME NO LIABILITY FOR CUSTOMS CLEARANCE.

\*Apple is a trademark of Apple Computer Inc.

## DEALER INQUIRIES REQUESTED

# BYTE-RYTE

DEPT. RE

P.O. BOX 205, STATION CART.

MONTREAL, QUEBEC, CANADA H4K 2J5

**(514) 335-1717**

\*Ram-Tech is a trademark of 99506 CANADA INC.



# NEW!

## Regency<sup>®</sup> Scanners

Communications Electronics,<sup>™</sup> the world's largest distributor of radio scanners, introduces new models with special savings on all radio scanners. Chances are the police, fire and weather emergencies you'll read about in tomorrow's paper are coming through on a scanner today.

We give you excellent service because CE distributes more scanners worldwide than *anyone* else. Our warehouse facilities are equipped to process thousands of scanner orders every week. We also export scanners to over 300 countries and military installations. Almost all items are in **stock for quick shipment**, so if you're a person who prefers fact to fantasy and who needs to know what's *really* happening around you, order your radio today from CE.

### NEW! Regency<sup>®</sup> MX3000

List price \$299.95/CE price \$199.00  
**6-Band, 30 Channel • No-crystal scanner**  
**Search • Lockout • Priority • AC/DC**  
Bands: 30-50, 144-174, 440-512 MHz.

The Regency Touch MX3000 provides the ease of computer controlled, touch-entry programming in a compact-sized scanner for use at home or on the road. Enter your favorite public service frequencies by simply touching the numbered pressure pads. You'll even hear a "beep" tone that lets you know you've made contact.

In addition to scanning the programmed channels, the MX3000 has the ability to search through as much as an entire band for an active frequency. The MX3000 includes channel 1 priority, dual scan speeds, scan or search delay and a brightness switch for day or night operation.

### NEW! Regency<sup>®</sup> HX650

List price \$119.95/CE price \$84.00  
**5-Band, 6 Channel • Handheld crystal scanner**  
Bands: 30-50, 146-174, 450-512 MHz.

Now you can tune in any emergency around town, from wherever you are, the second it happens. Advanced circuitry gives you the world's smallest scanner. Our low CE price includes battery charger/A.C. adapter.

### NEW! Regency<sup>®</sup> MX7000

Allow 120-240 days for delivery after receipt of order due to the high demand for this product.  
List price \$599.95/CE price \$449.00

**10-Band, 20 Channel • Crystalless • AC/DC**  
Frequency range: 26-27, 30-108, 108-136 AM, 144-174, 440-512, 806-881 MHz., 1.0 GHz., 1.1 GHz.

In addition to normal scanner listening, the MX7000 offers CB, VHF, and UHF TV audio, FM Broadcast, all aircraft bands (civil and military), 800 MHz communications, cellular telephone, and when connected to a printer or CRT, satellite weather pictures.

### NEW! JIL SX-200

CE price \$269.00/NEW LOW PRICE  
**8-Band, 16 Channel • No-crystal scanner**  
**Quartz Clock • AM/FM • AC/DC**  
Bands: 26-88, 108-180, 380-514 MHz.

Tune Military, F.B.I., Space Satellites, Police & Fire, D.E.A., Defense Department, Aeronautical AM band, Aero Navigation Band, Fish & Game, Immigration, Paramedics, Amateur Radio, Justice Department, State Department, plus thousands of other restricted radio frequencies no other scanner is programmed to pick up.

### NEW! JIL SX-100

CE price \$134.00/NEW LOW PRICE  
**6-Band, 16 Channel • Crystalless • AC/DC**  
Frequency range: 30-54, 140-174, 410-514 MHz.  
The JIL SX-100 scanner is a mobile keyboard programmable scanner that puts you in the seat of the action at home or in your car. Compact and good looking, the SX-100 even gives you the time and date. It's small size will easily fit in most domestic or foreign cars and it's AC/DC adaptable for home use.

### Regency<sup>®</sup> HX1000

Allow 90-180 days for delivery after receipt of order due to the high demand for this product.  
List price \$329.95/CE price \$209.00

**6-Band, 20 Channel • No Crystal scanner**  
**Search • Lockout • Priority • Scan delay**  
**Sidelit liquid crystal display**

Frequency range: 30-50, 144-174, 440-512 MHz.  
The new handheld Regency HX1000 scanner is fully keyboard programmable for the ultimate in versatility. You can scan up to 20 channels at the same time. When you activate the priority control, you automatically override all other calls to listen to your favorite frequency. The LCD display is even sidelit for night use. A die-cast aluminum chassis makes this the most rugged and durable hand-held scanner available. There is even a backup lithium battery to maintain memory for two years. Includes wall charger, carrying case, belt clip, flexible antenna and nicad battery. Reserve your Regency HX1000 now.

### Regency<sup>®</sup> R106

List price \$149.95/CE price \$99.00  
**5-Band, 10 Channel • Crystal scanner • AC/DC**  
Frequency range: 30-50, 146-174, 450-512 MHz.  
A versatile scanner, the Regency R-106 is built to provide maximum reception at home or on the road. Rugged cabinet protects the advanced design circuitry allowing you years of dependable listening.

### NEW! Regency<sup>®</sup> D810

List price \$399.95/CE price \$259.00  
**8-Band, 50 Channel • Crystalless • AC only**  
Bands: 30-50, 88-108, 118-136, 144-174, 440-512 MHz.  
This scanner offers Public service bands, plus Aircraft and FM broadcast stations. You can listen to Bach or a Boeing 747, the Rolling Stones or the riot squad, or any of 50 channels. Plus special direct access keys let you listen to police, fire, emergency, or any of your favorite channels just by pushing a button.

### Regency<sup>®</sup> R1040

List price \$199.95/CE price \$129.00  
**6-Band, 10 Channel • Crystalless • AC only**  
Frequency range: 30-50, 144-174, 440-512 MHz.  
Now you can enjoy computerized scanner versatility at a price that's less than some crystal units. The Regency R1040 lets you in on all the action of police, fire, weather, and emergency calls. You'll even hear mobile telephones.

Programming the R1040 is easy. Merely touch the keyboard and enter any of over 15,000 frequencies on your choice of 10 channels.

### TEST ANY SCANNER

Test any scanner purchased from Communications Electronics<sup>™</sup> for 31 days before you decide to keep it. If for any reason you are not completely satisfied, return it in original condition with all parts in 31 days, for a prompt refund (less shipping/handling charges and rebate credits).

### OTHER RADIOS & ACCESSORIES

Regency <sup>®</sup> C403 Scanner.....	\$59.00
NEW! Panasonic RF-B50 Shortwave receiver.....	\$129.00
Panasonic RF-9 Shortwave receiver.....	\$54.00
Panasonic RF-799 Shortwave receiver.....	\$219.00
Panasonic RF-2800 Shortwave receiver.....	\$199.00
Panasonic RF-2900 Shortwave receiver.....	\$249.00
Panasonic RF-3100 Shortwave receiver.....	\$269.00
Panasonic RF-6300 Shortwave receiver.....	\$539.00
NEW! Bearcat <sup>®</sup> 151 Scanner.....	\$169.00
NEW! Bearcat <sup>®</sup> Five-Six Scanner.....	\$129.00
Bearcat <sup>®</sup> 300 Scanner.....	\$349.00
Bearcat <sup>®</sup> 250 Scanner.....	\$279.00
Bearcat <sup>®</sup> 200 Scanner.....	\$189.00
Bearcat <sup>®</sup> 210XL Scanner.....	\$229.00
Bearcat <sup>®</sup> 20/20 Scanner.....	\$289.00
Bearcat <sup>®</sup> 100 Scanner.....	\$289.00
Bearcat <sup>®</sup> Weather Alert.....	\$49.00
Freedom Phone <sup>®</sup> 4000 Cordless telephone.....	\$239.00
Fanon FCT-200 Cordless telephone.....	\$139.00
Fanon 6-HLU Scanner.....	\$99.00
CHB-6 Fanon AC Adapter/Battery Charger.....	\$15.00
CAT-6 Fanon carrying case with belt clip.....	\$15.00
SP55 Carrying case for Bearcat <sup>®</sup> Five-Six.....	\$15.00
MA-506 Carrying case for Regency <sup>®</sup> HX650.....	\$15.00
SCMA-6 Fanon Mobile Charger/Audio Amplifier.....	\$49.00
AUC-3 Fanon autolighter adapter/Battery Charger.....	\$15.00
FB-E Frequency Directory for Eastern U.S.A.....	\$12.00
FB-W Frequency Directory for Western U.S.A.....	\$12.00
TSG "Top Secret" Registry of U.S. Government Freq.....	\$15.00
RRF Railroad Frequency Directory.....	\$10.00
ESD Energy Services Directory.....	\$10.00
ASD Frequency Directory for Aircraft Band.....	\$10.00
SRF Survival Radio Frequency Directory.....	\$10.00
TIC Techniques for Intercepting Comm. Manual.....	\$12.00
CIE Covert Intelligence, Elect. Eavesdropping Man.....	\$12.00
B-4 1.2 V AAA Ni-Cad batteries (set of four).....	\$9.00
B-6 1.2 V AA Ni-Cad batteries (set of four).....	\$12.00
A-135C Crystal certificate.....	\$3.00
Add \$3.00 shipping for all accessories ordered at the same time.	
Add \$12.00 per shortwave receiver for U.P.S. shipping.	

### INCREASED PERFORMANCE ANTENNAS

If you want the utmost in performance from your scanner, it is essential that you use an external antenna. We have a base and a mobile antenna specifically designed for receiving all bands. Order #A60 is a magnet mount mobile antenna and order #A70 is an all band base station antenna. Price is \$35.00 each plus \$3.00 for UPS shipping in the continental United States.

### BUY WITH CONFIDENCE

To get the fastest delivery from CE of any scanner, send or phone your order directly to our Scanner Distribution Center.<sup>™</sup> Be sure to calculate your price using the CE prices in this ad. Michigan residents please add 4% sales tax or supply your tax I.D. number. Written purchase orders are accepted from approved government agencies and most well rated firms at a 30% surcharge for net 30 billing. All sales are subject to availability, acceptance and verification. All sales on accessories are final. Prices, terms and specifications are subject to change without notice. All prices are in U.S. dollars. Out of stock items will be placed on back-order automatically unless CE is instructed differently. Minimum prepaid order \$35.00. Minimum purchase order \$200.00. Most products that we sell have a manufacturer's warranty. Free copies of warranties on these products are available prior to purchase by writing to CE. International orders are invited with a \$20.00 surcharge for special handling in addition to shipping charges. All shipments are F.O.B. Ann Arbor, Michigan. No COD's please. Non-certified and foreign checks require bank clearance.

**Mail orders to:** Communications Electronics<sup>™</sup> Box 1002, Ann Arbor, Michigan 48106 U.S.A. Add \$7.00 per scanner for U.P.S. ground shipping and handling in the continental U.S.A. If you have a Visa or Master Card, you may call and place a credit card order. Order toll-free in the U.S. Dial 800-521-4414. In Canada, order toll-free by calling 800-265-4828. Telex anytime 810-223-2422. If you are outside the U.S. or in Michigan dial 313-973-8888. Order today.

Scanner Distribution Center<sup>™</sup> and CE logos are trademarks of Communications Electronics<sup>™</sup>.

<sup>†</sup> Bearcat is a federally registered trademark of Electra Company, a Division of Masco Corporation of Indiana.  
<sup>‡</sup> Regency is a federally registered trademark of Regency Electronics Inc.

AD #092683

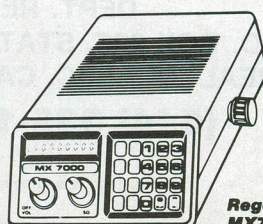
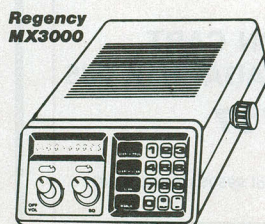
Copyright ©1983 Communications Electronics

Order Toll Free... call  
**1-800-521-4414**

**COMMUNICATIONS ELECTRONICS<sup>™</sup>**

**Consumer Products Division**

818 Phoenix □ Box 1002 □ Ann Arbor, Michigan 48106 U.S.A.  
Call toll-free 800-521-4414 or outside U.S.A. 313-973-8888





## SPECIAL ISSUE: VIDEO ELECTRONICS

- 49 VIDEO COLOR PROCESSOR**  
Give your new videotapes that "professionally edited" look, and spruce up your old tapes for more enjoyable viewing. **Roger Cota and Lloyd Addington**
- 58 NEW IC'S FOR DIGITAL TV**  
A look at the not-too-distant future in consumer-television design. **Robert Grossblatt**
- 64 VCR REPAIRS AND ADJUSTMENTS THAT YOU CAN DO**  
Repairing VCR's should, in general, be left to professionals. But here are some things you can do for yourself. **John D. Lenk**
- 69 WHAT'S NEW IN PORTABLE VIDEO**  
A look at what's current and what's to come in the portable-video industry. **Carl Laron**

## BUILD THIS

- 75 TYPEWRITER-TO-COMPUTER INTERFACE**  
Now you can get letter-quality printing on a budget by using your IBM typewriter as a printer—with a 30K buffer! **Bill Green**
- 86 INTERFERENCE TRAPS FOR SWL'S**  
If you're bothered by interference from local broadcast-band stations, here's something you can do something about it. **R. W. Burhans**

## TECHNOLOGY

- 4 VIDEO ELECTRONICS**  
Tomorrow's news and technology in this quickly changing industry. **David Lachenbruch**
- 14 SATELLITE/TELETEXT NEWS**  
The latest happenings in communications technology. **Gary H. Arlen**
- 20 VIDEOGAMES**  
Holiday shopping. **Danny Goodman**

## CIRCUITS AND COMPONENTS

- 38 NEW IDEAS**  
An award-winning project from one of our readers.
- 81 HOW TO DESIGN ANALOG FILTER CIRCUITS**  
A look at both active and passive filters. **Mannie Horowitz**
- 88 DRAWING BOARD**  
More about counters. **Robert Grossblatt**
- 97 HOBBY CORNER**  
More from our mailbag. **Earl "Doc" Savage, K4SDS**
- 103 STATE OF SOLID STATE**  
High-voltage transistors. **Robert F. Scott**

## VIDEO

- 101 SERVICE CLINIC**  
More tips on opening your own shop. **Jack Darr**

## COMPUTERS

- 79 SPELL CHECKERS**  
What spelling and style checkers can do for you. **Herb Friedman**

## EQUIPMENT REPORTS

- 28 Heath Model EH-701 Linear-Circuits Course**
- 32 Tektronix Model 221 Portable Oscilloscope**

## DEPARTMENTS

- 10 Advertising and Sales Offices**
- 140 Advertising Index**
- 141 Free Information Card**
- 24 Letters**
- 111 Market Center**
- 93 New Literature**
- 40 New Products**
- 8 What's News**

## SEASON'S GREETINGS

*The editors and staff  
of Radio-Electronics  
join in sending  
holiday greetings and  
our best wishes for  
a happy new year*

## ON THE COVER

If you're like many home-video hobbyists, your videotapes leave something to be desired. Your colors may appear washed out, the picture is filled with noise, or, perhaps your edits are far from smooth. Well, there's a way around those problems, whether you're making new tapes or duplicating old ones. With the color processor you can create fade-ins and fade-outs, reduce background noise, and you can vary color saturation from black-and-white to full chrominance. The article describing its construction—which is only one of our special video features this month—begins on page 49.

**Radio-Electronics**, (ISSN 0033-7862) Published monthly by Gernsback Publications, Inc., 200 Park Avenue South, New York, NY 10003. Second-Class Postage Paid at New York, N.Y. and additional mailing offices. One-year subscription rate: U.S.A. and U.S. possessions, \$14.97, Canada, \$17.97. Other countries, \$22.47 (cash orders only, payable in U.S.A. currency). Single copies \$1.50. © 1983 by Gernsback Publications, Inc. All rights reserved. Printed in U.S.A.

**Subscription Service:** Mail all subscription orders, changes, correspondence and Postmaster Notices of undelivered copies (Form 3579) to Radio-Electronics Subscription Service, Box 2520, Boulder, CO 80322.

A stamped self-addressed envelope must accompany all submitted manuscripts and/or artwork or photographs if their return is desired should they be rejected. We disclaim any responsibility for the loss or damage of manuscripts and/or artwork or photographs while in our possession or otherwise.



# VIDEO ELECTRONICS

DAVID LACHENBRUCH  
CONTRIBUTING EDITOR



## VIDEOMOVIE

The surprise hit of Berlin's big Audio and Video Fair was *Videomovie*, a combination VCR and camera using the VHS-C cassette. Obviously introduced to compete with Sony's *Betamovie*, *Videomovie* weighs only 4.2 pounds without cassette and battery, 4.6 pounds with them—more than a pound lighter than *Betamovie* when empty, almost two pounds less when loaded. (See left-hand photo.)

But *Videomovie* is a complete self-contained system. It includes a 1/2-inch Saticon pickup tube, 6:1 motorized zoom, 1/2-inch electronic viewfinder, and all VCR controls. *Betamovie*, which has the same power zoom, is a record-only device with a through-the-lens optical viewfinder. *Betamovie* has the advantage in recording time, since it accommodates a full-size Beta cassette, while *Videomovie* uses the small version of the VHS cassette which will record only for 20 minutes (30 minutes in the European version). The VHS-C cassette can be played back on a standard VHS recorder using a cassette adaptor.

*Videomovie*, so far made only by JVC, but to be offered under a variety of brand names, is scheduled for marketing next year—announced first in Europe, but destined to come to the U.S. as well—while *Betamovie* is already in limited distribution. The introduction of *Videomovie* could cause some manufacturers to rethink their plans to market the new 8-mm video format next year. In fact, there is considerable sentiment in Japan to put 8-mm back on the drawing board and re-engineer it to use a more sophisticated recording technique known as Timeplex, which would make the same tapes playable on NTSC, PAL, or SECAM color sets and accommodate future developments such as digital TV and high-definition as well. The re-engineering of the 8-mm standard would make it probable that no new VCR format would emerge for three or four years.

## 5-INCH PROJECTION TV

"Giant screen" and "projection TV" are no longer synonymous—not since Panasonic displayed a prototype five-inch projection set. The little set is designed for use as a desktop monitor and folds into a compact size not more than three inches high. (See right-hand photo.) When opened, a translucent screen pops up and three tiny projection tubes two inches in diameter (one for each color) throw a well-defined color picture on the screen, over five foot-lamberts bright. The whole thing weighs less than seven pounds and operates from AC or battery. Panasonic declined to give out price or availability date.

## NEW TUBE FAMILY

The most dramatic trend for 1984 is the new series of FS (for Flat Square) picture tubes that is appearing in color sets for the first time. Pioneered by Toshiba, and destined eventually to spread to all other manufacturers, the new tubes have extremely rectangular corners and a virtually flat faceplate contour. They are specifically designed for better presentation of computer graphics, as well as more aesthetic set design and wider viewing angle. Because of the squarer corners, diagonal measurement is increased—the 20-inch FST replacing the existing 19-inch, 14-inch replacing 13-inch and eventually (probably next year) a 26-inch FST for applications that currently use 25-inch. The first sets using the new tube configuration are several 14- and 20-inch models from Toshiba and a 20-inch Toshiba-made monitor-receiver sold under the Sears brand, to be followed shortly by a 20-inch from Hitachi, with other brands to be phased in later in the year.

R-E



# 100 MHz scope, counter, timer, multimeter: All one integrated system.

**100 MHz dual time base scope.** 3.5 ns risetime; sweeps from 0.5 s to 5 ns/div; alternate sweep;  $\pm 2\%$  vertical/horizontal accuracy; vertical sensitivity to 2 mV/div @ 90 MHz.

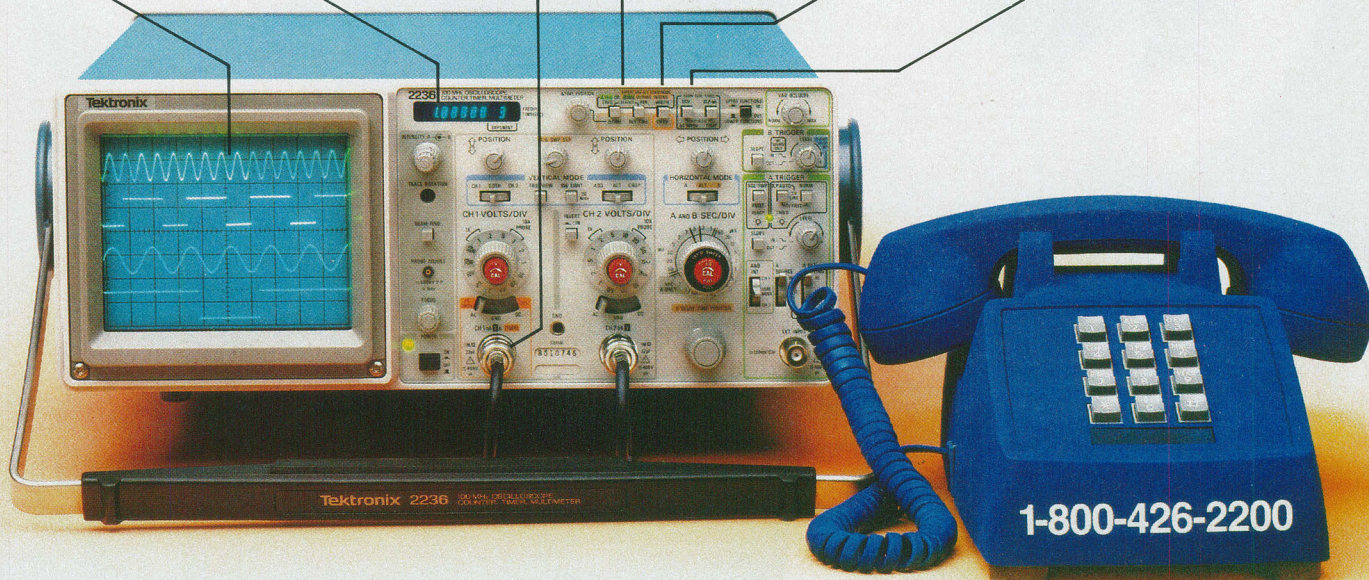
**9-digit fluorescent display.** Digitally accurate readouts accompany the CRT waveform. Error messages and prompts also appear on the display.

**Dc volts and ac coupled true RMS volts.** Measured through the Ch 1 scope input.

**Gated measurements.** Use the scope's intensified marker to measure frequency, period, width and to count events within specified portions of the signal.

**Auto-ranged, auto-averaged counter/timer.** Frequency, period, width, delay time,  $\Delta$ -time, plus totalize to more than 8 million events—with 7 digits plus exponent displayed.

**Auto-ranged DMM.** Use floating DMM side inputs with up to 5000-count resolution. Get precise readouts of average dc and true RMS voltage. Measure resistance from milliohms to gigohms.



**Now make measurements faster, easier, with greater accuracy and user confidence.** The Tek 2236 makes gated counter measurements, temperature, time, frequency, resistance and voltage measurements push-button easy. You see results concurrently on the 9-digit numeric readout and CRT display.

Its complete trigger system includes pushbutton trigger view, plus peak-to-peak auto, TV line, TV field, single sweep and normal modes.

At just \$2650\*, the 2236 includes the industry's first 3-year warranty on all parts and labor, including the CRT.

**Integrated measurement system. 3-year warranty. 15-day return policy. And expert advice. One free call gets it all!** You can order, or obtain literature, through the Tek National Marketing Center. Technical personnel, expert in scope applications, can answer your questions and expedite delivery. Direct orders include operating and

service manuals and worldwide service back-up.

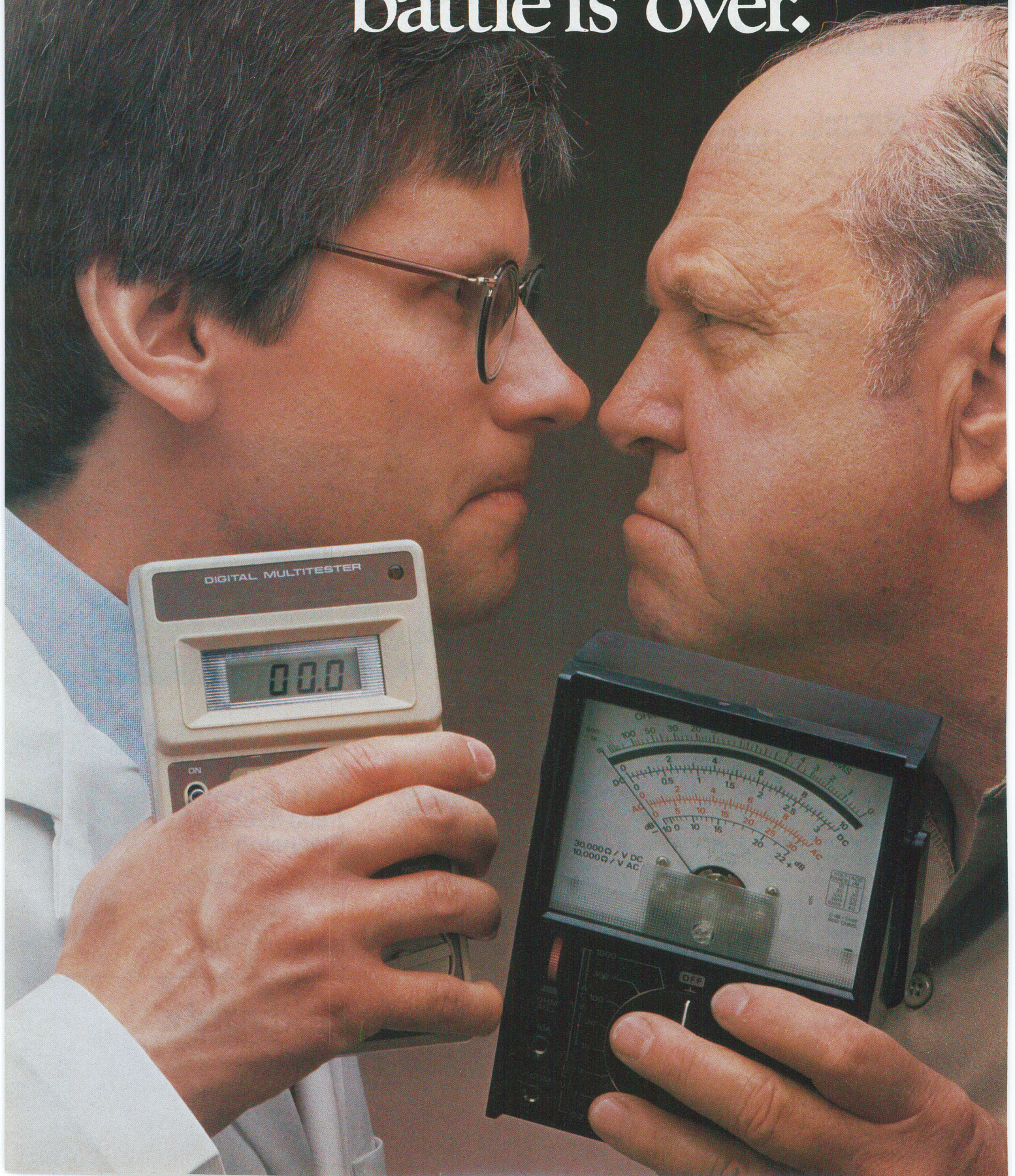
**Call toll-free:  
1-800-426-2200,  
Extension 107.**

In Oregon, call collect:  
(503) 627-9000, Ext. 107.  
Or write Tektronix, Inc.  
P.O. Box 1700  
Beaverton, OR 97075

**Tektronix®**  
COMMITTED TO EXCELLENCE

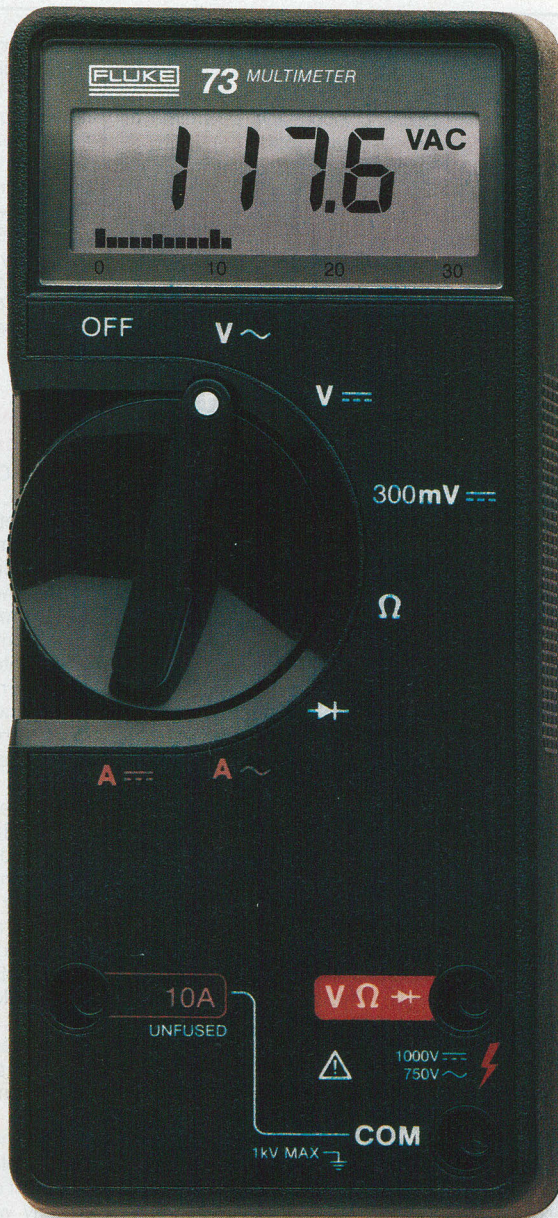


# The Digital vs. Analog battle is over.





# And the new champion is \$85.\*



Actual Size

Never before has the world seen multimeters like these.

## The new Fluke 70 Series.

They combine digital and analog displays for an unbeatable two-punch combination.

Now, digital users get the extra resolution of a 3200-count LCD display.

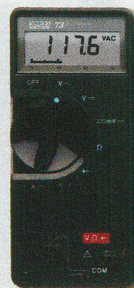
While analog users get an analog bar graph for quick visual checks of continuity, peaking, nulling and trends. Plus unparalleled operating ease, instant autoranging, 2,000+ hour battery life and a 3-year warranty. All in one meter.

Choose from three new models. The Fluke 73, the ultimate in simplicity. The feature-packed Fluke 75. Or the deluxe Fluke 77, with its own multipurpose protective holster and unique "Touch Hold" function (patent pending) that captures and holds readings, then beeps to alert you.

Each is Fluke-tough to take a beating. American-made, to boot. And priced to be, quite simply, a knockout.

For your nearest distributor or a free brochure, call toll-free anytime **1-800-227-3800, Ext. 229**. From outside U.S., call 1-402-496-1350, Ext. 229.

FROM THE WORLD LEADER  
IN DIGITAL MULTIMETERS.



### Fluke 73

**\$85\***  
Analog/digital display  
Volts, ohms, 10A, diode test  
Audible continuity  
0.7% basic dc accuracy  
2000+ hour battery life  
3-year warranty



### Fluke 75

**\$99\***  
Analog/digital display  
Volts, ohms, 10A, mA, diode test  
Audible continuity  
Autorange/range hold  
0.5% basic dc accuracy  
2000+ hour battery life  
3-year warranty



### Fluke 77

**\$129\***  
Analog/digital display  
Volts, ohms, 10A, mA, diode test  
Audible continuity  
"Touch Hold" function  
Autorange/range hold  
0.3% basic dc accuracy  
2000+ hour battery life  
3-year warranty  
Multipurpose holster

\* Suggested U.S. list price, effective October 1, 1983.





# WHAT'S NEWS

## Computer now transforms mechanics into experts

A computerized troubleshooting system that promises to make an expert out of the most inexperienced mechanic has been demonstrated by scientists of the General Electric Co. to the annual meeting of the American Association for Artificial Intelligence, in Washington, DC.

The unit—a small computer and its associated hardware—combines recent advances in artificial intelligence with the accumulated expertise of a skilled engineer.

For the "body of knowledge" of the system, a team of computer specialists spent several months interviewing GE's top service engineer, David I. Smith, an expert with more than 40 years of experience

in troubleshooting diesel-electric locomotives. The team then devised a custom-software program that made it possible for the computer to make the relevant portions of that information available to the repair mechanic on demand.

The system questions the repairman as to symptoms, displaying a list of possible malfunctions. When the mechanic selects one, the computer asks more detailed questions to pinpoint the problem. The system then operates along human thought lines, reasoning: "If this and this are true, then this..." and directs the mechanic toward the probable trouble. It can then lead him through the repair presenting detailed, computer-aided drawings of parts and sub-systems and specific "how-to" instructions.

The electronic troubleshooter is expected to have a major impact on the locomotive-service field, by slashing locomotive downtime as well as repair costs.

## Personal computer sales to quadruple in Japan

By 1990, says the Japan Electronics Industry Association (JEIA), Japan's personal computer industry will have increased more than four times. Based on a survey of Japan's 12 leading computer manufacturers, shipments are expected to top five million units by the end of the decade, nearly seven times the 1982 figure of 762,000 units. Gross sales volume is expected to rise about 4.3 times, to more than \$4.1 billion.

## Navigation satellites are aiding science

Due to a development by time and frequency scientists at the National Bureau of Standards (NBS), the Global Positioning Satellites (GPS) of the Department of Defense will be able to perform a new and valuable function.

The GPS's give the United States a world-wide, state-of-the-art navigation system. In addition to that function, NBS scientists are using them to synchronize clocks at remote locations to less than 10 billionths of a second (10 nanoseconds). Precise synchronization is necessary for clocks that serve navigation, space probes, and power networks, and a great deal of energy and money is needed to keep them synchronized.

To use the GPS satellites, it was necessary to develop a satellite receiver with a billionth-of-a-second stability in the delay time of its receiver circuit. NBS scientists designed such a receiver, and the computer software to go with it.

With that equipment, they have compared the atomic clocks at NBS in Boulder, CO, with those of the U.S. National Observatory in Washington, DC, 1500 miles away, with an uncertainty of less than 10 nanoseconds.

The system is also being used for synchronizing (equalizing the frequency of) the Jet Propulsion Laboratory's deep-space tracking stations at Gladstone, CA; Madrid,

Spain; and Canberra, Australia. Frequencies are now being equalized with accuracy ten times that required by JPL, and at a fraction of the former cost.

All the components that make that high-accuracy comparison possible will soon be available for commercial use. Interested persons may obtain information from D. W. Allan, Time and Frequency Division, National Bureau of Standards, 325 Broadway, Boulder, CO, 80303.

## New hole-making method for color display masks

Two RCA engineers have been issued a patent for an improved method of etching the tiny holes in shadow masks for the color CRT's used to display computer data.

Shadow masks for display or TV CRT's are normally made by moving a continuous strip of steel, or other material, through an etching chamber, where the sheet is sprayed with etching fluid on both sides. (The two sides of the sheet are covered with a photo-resist with openings that are registered with each other.)

Since the effects of the etch tend to spread out, as well as pierce through the material, various methods have been tried to keep the holes as small as possible to improve the resolution of the image. The commonest approach has been to do most of the etching on one side, then finish by etching in only a short distance from the other side that produces a tapered hole with a small, very clearly defined aperture.

The small-hole side has usually been protected during the earlier stages of etching by coating it temporarily with etch-resistant material, or by covering it with a plastic sheet during the first stages of the etching.

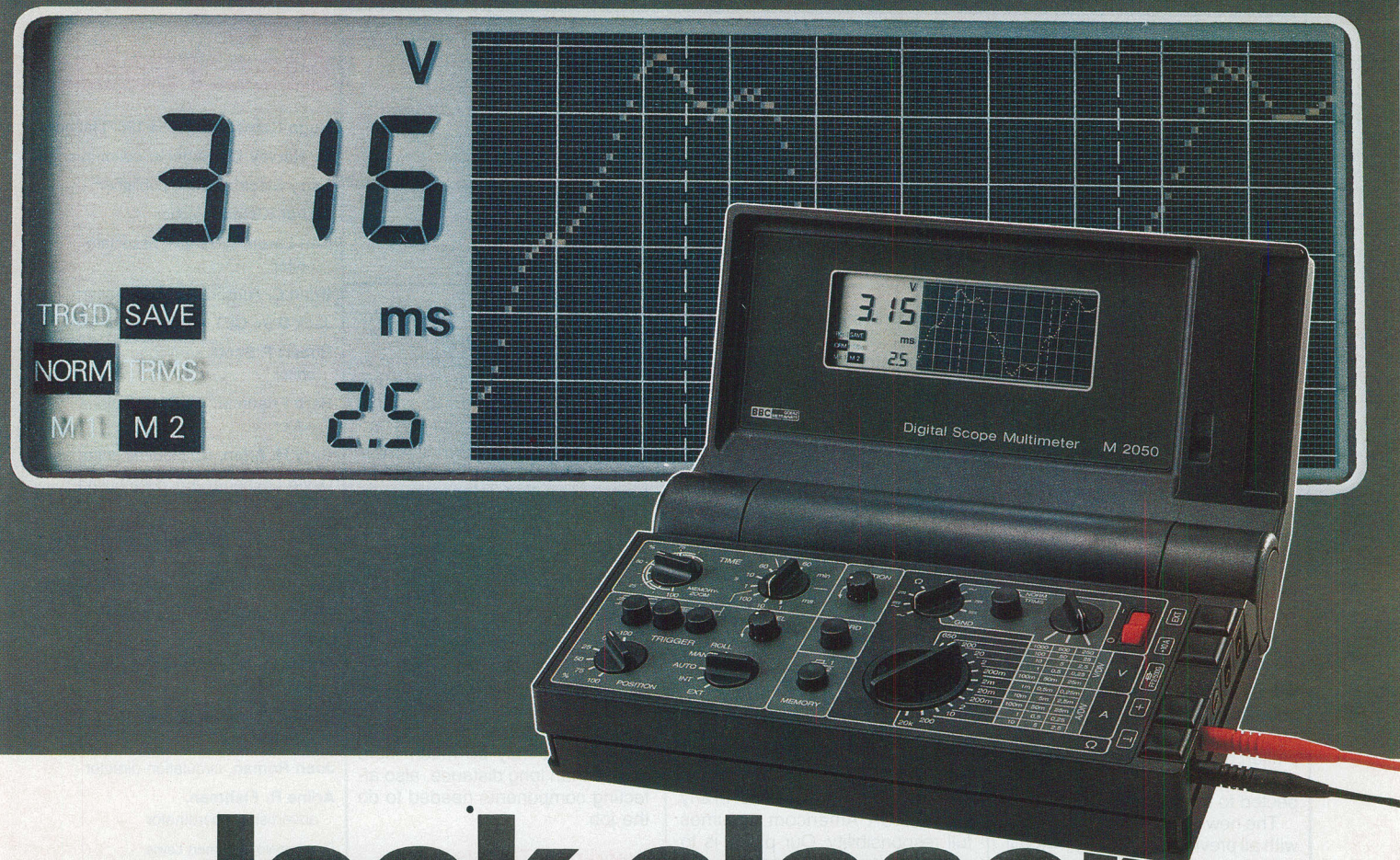
The new patent, No. 4,389,279, places a wall behind and spaced from the material being etched. End seals are placed between the wall and the edges of the strip. The pressure in the chamber behind the strip can be made higher than the pressure on the other side of the strip, keeping out all etching fluid.

When the process is nearly com-  
*continued on page 10*



**CATS-1, GE'S NEW COMPUTERIZED TROUBLESHOOTER** that makes the inexperienced locomotive mechanic into an expert. It can ask questions, diagnose problems, show detailed drawings of the locomotive's components (screen at right), and even demonstrate repair procedures on a video monitor (screen at left). Francis S. Lynch, head of the team that devised the software program, is seated before the instrument; David Smith, whose expertise was tapped to supply the computer with its body of knowledge, stands behind it.





# look closer at a DSM!

**Here's a flat-panel scope, a transient recorder, and a 32-range DMM in a compact 4 lb. box.**

Now you can use one instrument to capture 2  $\mu$ s transients, evaluate their waveform characteristics on a flat-panel LCD, and simultaneously measure their true RMS values.

It's all made possible with the first in a new class of instruments from BBC, the Digital Scope Multimeter, Model M 2050 DSM. By applying precision European engineering to the measurement needs of design and service engineers, BBC is revolutionizing test and measurement.

## Large Flat-Paneled Scope Display

The LCD provides excellent resolution, 128 dots by 64 dots, for waveform displays. It measures 4-5/8 in. (118 mm) x 1-5/8 in. (42 mm). Simultaneous display capabilities let you use the scope portion of the LCD to evaluate signal characteristics while the DMM portion displays the true RMS signal value. Your measurement evaluations will be more accurate and consistent.

## Transient Recording

Two independent memories of 512 words (horizontal dots) with 8-bit vertical resolution let users capture information about events ranging from 2  $\mu$ s to 1-hr in duration. Five selectable trigger points (0, 25%, 30%, 75%, and 100%) give users options as to how much data is stored before and after the triggering event.

## True RMS Multimeter Measurements

You get 15 voltage ranges (to 650V), 15 current ranges (to 10A), and two resistance ranges (200 $\Omega$  and 20k $\Omega$ ). True RMS and Averaging RMS modes are switch selectable. All ranges are overload-protected (Spikes to 6,000 V or 60A).

## Performance Packed and Portable

An impact resistant case protects the M 2050 DSM. When open, the display angle is easily adjustable. When closed, the display and the controls are protected, the meter shuts itself off, and the tilt bail becomes a carrying handle.

## Affordable and Available

The price of the M 2050 DSM is only \$1,795.00 (for the optional analog output, add \$200.00). Rechargeable batteries for 8 hours of portable operation are available for \$35.00.

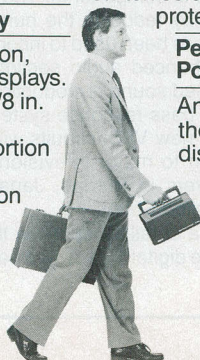
BBC's M 2050 DSM and other innovative instruments are available via select distributors throughout the U.S. If your instrumentation supplier doesn't carry BBC yet, we'll gladly tell you who does. Call toll free:

**1-800-821-6327**  
(In CO, 303-469-5231)

BBC-Metrawatt/Goertz  
6901 W. 117th Avenue  
Broomfield, CO 80020, Telex 45-4540

*Engineering Excellence in Test and Measurement*

**BBC** **GOERZ**  
**METRAWATT**



CIRCLE 60 ON FREE INFORMATION CARD



# WHAT'S NEWS

continued from page 8

plete, etching is allowed to take place on both sides of the strip. Thus the holes on the wall side are etched only a small portion of the strip's total thickness, making for smaller and more precisely defined holes. Beside making for greater resolution in the display, the new method is not as expensive nor as difficult to operate as are the older methods.

## New transpacific cable to use optical fibers

Japan's international communications company, KDD; American Telephone and Telegraph (AT&T), and 25 other companies have agreed on 1988 as the target-completion date for a new transpacific submarine cable. Work is expected to begin in mid-1984.

The new cable will make a break with all previous technology—it will use optical fibers and transmit at visible-light frequencies.

The new cable is called TPC 3. (There were two earlier cables to Japan. TPC 1 runs from Japan to Hawaii via Guam, Wake, and Midway islands, with 138 telephone circuits; TPC 2 from Okinawa to Hawaii via Guam, with 845 telephone circuits.) The number of circuits that TPC 3 will carry has not yet been set, but it is estimated that it will be more than 4,000.

The exact route of the new cable has not yet been decided. It has been proposed that it run direct from Japan to Hawaii, a distance of more than 4,000 miles, on its way to the west coast of the United States. Laying the cable will be a major engineering feat. Even if the shallowest route is selected, it will be necessary to lay the optical-fiber cable at depths of 16,500 to more than 19,000 feet.

## Echo cancellers improve satellite transmissions

RCA Americom reports that echo cancellers are installed on all its satellite private lines to eliminate the annoying echo or clipping that has been characteristic of satellite transmissions in the past. It was the first satellite carrier to install echo cancellers on all retail circuits at no cost to the customer, says Americom president Dr. James A. Tietjen, and is the only carrier that

continues to provide that service at no cost.

The Satcom satellite system now carries more than 10,000 dedicated voice lines, Dr. Tietjen stated. Those lines are being used by direct customers of RCA Americom, and by other common carriers marketing both private-line and metered services for business and residential long-distance telephone calls.

The superior quality of satellite service as compared to terrestrial links is credited for that growth. "Our leased channel availability is consistently over 99 percent," Dr. Tietjen reported. "To the extent that service interruptions do occur, in 75 percent of the cases they are related to the local loops connecting the customer's telephone to our central terminal office. In any event, RCA Americom assumes full responsibility. Our policy is to act on customers' complaints immediately, and to notify them every two hours of our progress in service restoration."

## FCC approves pager for use with SCA's

The Federal Communications Commission has approved the first pager for use with the sub-carrier channels of FM radio stations. The decision opened the door to paging over sub-carrier channels, with its benefits of lower costs and greater range.

The tone-and-voice pager approved is the TVC-1, distributed by Reach, Inc., of Lincoln, NE.

TVC-1 has an audio output of 150 mW and runs up to 12 months without a battery change. Group-calling capability, a vibrator operated independently of the voice signal, and an ON/OFF switch are optional equipment.

Information on the TVC-1 can be obtained from Reach, Inc., 301 S. 68th St., Lincoln, NE 68510.

## Fiber optics has uses outside communications

Non-communication or short-haul communications uses for fiber optics may become a half-billion-dollar market in the near future, according to Frost & Sullivan, a market research organization based in New York and London.

Those applications, in computer systems, instrumentation, process control, local-area communications networks, and the military will generate \$475 million in annual component sales by 1990, as compared to only \$47 million last year, says Frost & Sullivan in a 255-page report, "The Non-Telecommunications Fiber Optic Component Market."

Components, says the report, usually need not be the same as needed for telecommunications. For short-haul uses, LED emitters may be used instead of laser diodes and PIN photo diodes instead of the costly avalanche types needed in telecommunications. But the short-haul transmission environment may be much more hostile than long distance, also affecting components needed to do the job.

## First digital TV sets shown in Europe

The world's first production color-television sets using digital signal-processing techniques were shown in public at the International Radio and Television Show in West Berlin, last September.

Both picture and sound signals are processed digitally, with claimed advantages in long-term picture-quality stability, true high-fidelity stereo sound, simplified inclusion of videotext, easier and more accurate service adjustments, and increased reliability.

The new sets were demonstrated by Standard Electric Lorenz, an ITT company, and are being sold under the brand names of ITT and Graetz.

Seven very-large-scale integrated circuits (VLSI), designed and patented by ITT Semiconductors Worldwide (Freiburg, Federal Republic of Germany) are being used to replace some 300 conventional components. The space saved by reducing the number of parts has been used to incorporate an enhanced audio section, with improved sound reproduction from a new bass-response system.

The new VLSI circuits will be licensed to major television manufacturers in Europe, Japan and the United States.

For a detailed report on the ICs and the digital TV set, see page 58.

R-E

## Radio-Electronics

Hugo Gernsback (1884-1967) founder

M. Harvey Gernsback, editor-in-chief

Larry Steckler, CET, publisher

Arthur Kleiman, editor

Carl Laron, WB2SLR, associate editor

Brian C. Fenton, assistant editor

Jack Darr, CET, service editor

Robert F. Scott, semiconductor editor

Herb Friedman, communications editor

Gary H. Arlen, contributing editor

David Lachenbruch, contributing editor

Earl "Doc" Savage, K4SDS, hobby editor

Danny Goodman, contributing editor

Dan Rosenbloom, production manager

Robert A. W. Lowndes, production associate

Dianne Osias, production assistant

Joan Roman, circulation director

Arline R. Fishman, advertising coordinator

Cover photo by Robert Lewis

Radio-Electronics is indexed in *Applied Science & Technology Index* and *Readers Guide to Periodical Literature*.

Gernsback Publications, Inc.  
200 Park Ave. South  
New York, NY 10003  
President: M. Harvey Gernsback  
Vice President: Larry Steckler

ADVERTISING SALES 212-777-6400

Larry Steckler  
Publisher

### EAST/SOUTHEAST

Stanley Levitan  
Radio-Electronics  
200 Park Ave. South  
New York, NY 10003  
212-777-6400

### MIDWEST/Texas/Arkansas/Okla.

Ralph Bergen  
Radio-Electronics  
540 Frontage Road Suite 325  
Northfield, Illinois 60093  
312-446-1444

### PACIFIC COAST Mountain States

Marvin Green  
Radio-Electronics  
413 So. La Brea Ave.  
Los Angeles, CA 90036  
213-938-0166-7







See here for the  
many ways to say  
**MERRY CHRISTMAS**  
with a timely gift  
from the big, wide,  
wonderful world of  
**ZENITH**  
**VIDEO/AUDIO**  
**ACCESSORIES**

Now, with Christmas just around the corner, Zenith introduces a whole host of video/audio accessories. And every one of them about as sensible and rewarding a gift as you could wish on anyone...including yourself.

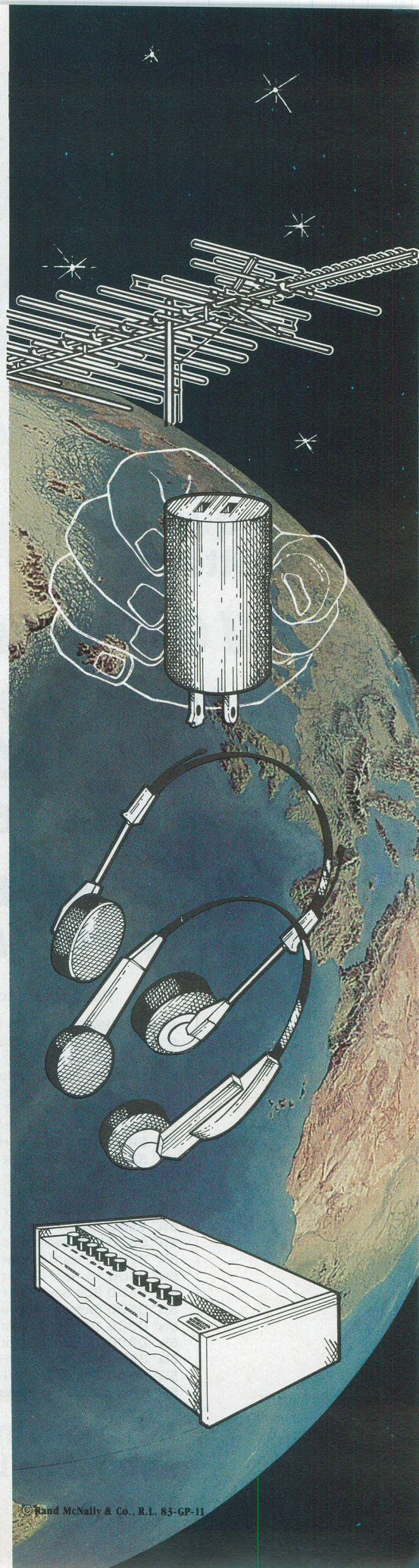
Chief among them, perhaps, in terms of TV convenience is the Zenith Video Organizer that lets you switch—with pushbutton ease!—from one program source to another without manually changing cable connections.

Individually packaged and clearly labeled, too, are such TV accessories as dust covers, video tape ID kits, cassette storage modules, signal splitters, attenuators, terminators, A-B switches, "F", mini and other types of plugs and jacks in virtually any combination...plus cables in a variety of lengths, each with gold-electroplated connectors.

Also included in this, the biggest, broadest-ever Zenith line of video, audio and telephone accessories, are indoor and outdoor antennas...super lightweight stereophones...and the Zenith Spike Suppressor to protect the TVs, home appliances, and solid-state electronics in your home from damaging high-voltage surges.

Now's the time to check on these new Zenith video/audio accessories for your Christmas shopping or hinting list. They're at your dealer's proudly bearing TV's leading name in performance and reliability. Go see. And remember, Zenith sends you!

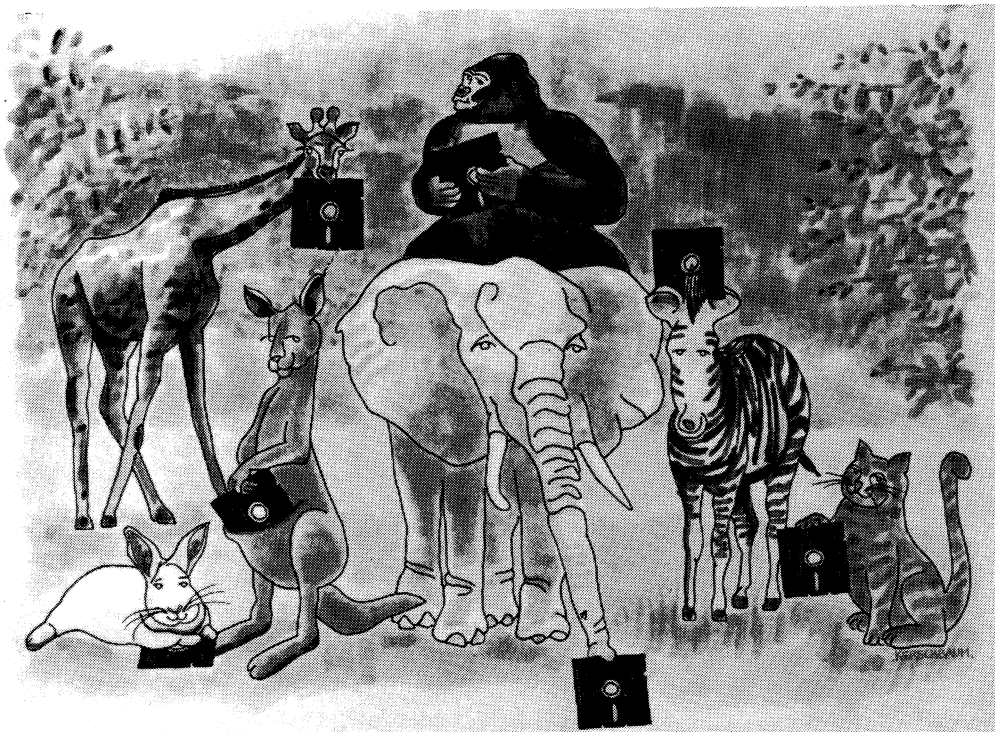
**ZENITH**  
®  
The quality goes in before the name goes on.®





# Diskette Users...

When you've heard from all the animals in the diskette zoo, but you need fast delivery and high quality diskettes...



## Call Communications Electronics

Diskette order desk

**800-521-4414**

In Canada 800-265-4828



**Choose your brand**  
**Choose your price**

**Wabash**  
**diskettes** for as low as  
**\$1.29 each**

**Ultra**  
**diskettes** for as low as  
**\$1.39 each**

### Product Description

8" SSDD IBM Compatible 128B/S, 26 Sector  
8" SSDD Shugart Compatible, 32 Hard Sector  
8" SSDD IBM Compatible (128 B/S, 26 Sectors)  
8" DSDD Soft Sector (Unformatted)  
8" DSDD Soft Sector (256 B/S, 26 Sectors)  
8" DSDD Soft Sector (512 B/S, 15 Sectors)  
8" DSDD Soft Sector (1024 B/S, 8 Sectors)  
5 1/4" SSDD Soft Sector w/Hub Ring  
5 1/4" SSDD Same as above but bulk product  
5 1/4" SSDD 10 Hard Sector w/Hub Ring  
5 1/4" SSDD 16 Hard Sector w/Hub Ring  
5 1/4" SSDD Soft Sector w/Hub Ring  
5 1/4" SSDD Same as above, but bulk product  
5 1/4" SSDD Soft Sector Flippy (use both sides)  
5 1/4" SSDD 10 Hard Sector w/Hub Ring  
5 1/4" SSDD 16 Hard Sector w/Hub Ring  
5 1/4" DSDD Soft Sector w/Hub Ring  
5 1/4" DSDD Same as above, but bulk product  
5 1/4" DSDD 10 Hard Sector w/Hub Ring  
5 1/4" DSDD 16 Hard Sector w/Hub Ring  
5 1/4" SSDD Soft Sector w/Hub Ring (96 TPI)  
5 1/4" DSDD Soft Sector w/Hub Ring (96 TPI)  
5 1/4" Fileware Diskette for Apple® Lisa Computer

Wabash Part #	CE quant. 100 price per disk (\$)
F111	1.89
F31A	1.89
F131	2.39
F14A	2.99
F144	2.99
F145	2.99
F147	2.99
M11A	1.49
M11AB	1.29
M41A	1.49
M51A	1.49
M13A	1.79
M13AB	1.59
M18A	2.69
M43A	1.79
M53A	1.79
M14A	2.69
M14AB	2.49
M44A	2.69
M54A	2.69
M15A	2.59
M16A	3.69

Ultra Part #	CE quant. 100 price per disk (\$)
81726	1.99
81701	2.49
82701	3.19
82708	3.19
50001	1.79
00153	1.39
50010	1.79
50016	1.79
51401	1.89
00096	1.59
51410	1.89
51416	1.89
52401	2.79
00140	2.49
52410	2.79
52416	2.79
51801	2.59
52801	3.69

**For more information**  
**about this brand call:**

**6 year warranty**  
For more info on Wabash call  
**800-323-9868**  
In Illinois 312-593-6363

**Lifetime warranty except bulk**  
For more info on Ultra call  
**408-728-7777**  
Monday-Friday 9 am-4 pm PT



## CE...your best source for diskettes

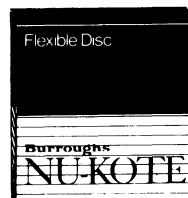
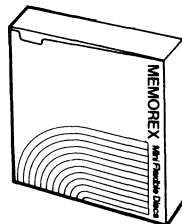
For you the diskette buyer, it's a jungle out there. There are so many different brands to choose from, you need to go on a safari to find a good brand at a reasonable cost. Fortunately, CE has already hunted for the best diskettes and offers you an excellent choice at a CE price. To save you even more, CE also offers bulk product where 100 diskettes are packed in the same box without envelopes or labels. Since we save packaging costs, these savings are passed on to you. Diskette envelopes are also available from CE.

## Other Useful Computer Accessories

When the read/write heads on your computer are dirty, that can cause you a lot of grief. Now...with CE **Head Cleaning Diskettes**, you can clean the read/write heads on the diskette drives yourself in just 30 seconds. Each kit contains two head cleaning diskettes, and enough solution for 30 cleanings. Order # 5-CLE for 5 1/4" drives and order # 8-CLE is for 8" drives. Only \$25.00 each. Also available from CE are **3M data cartridges**. The DC100A data cartridge is a small version of the DC300A data cartridge. The DC100A contains 140 feet of 0.150" tape in a package measuring 2.4 x 3.2 x 0.5 inches. Cost is \$14.00 each. The DC300A is a pre-loaded tape cartridge containing 300 feet of one mil thick by 1/4" computer tape. The DC300A costs \$18.00 each. The DC300XL is an extra length data cartridge with 450 feet of tape. It is the same size and interchangeable with the DC300A. The DC300XL provides a total storage capacity of 34.5 million bits at 1600 BPI. The cost of the DC300XL is \$22.00 each. If you need **extra mini-diskette envelopes**, CE sells super strong and tear resistant Tyvek® envelopes for \$12.00 per 100 pack. Use order # TE-5 for a 100 pack of 5 1/4" diskette envelopes. **Smith-Corona TP-1 letter quality printers** are available in serial or parallel versions for only \$529.00 each.

## Quantity Discounts Available

Our diskettes are packed 10 disks to a carton and 5 or 10 cartons to a case. The economy bulk pack is packaged 100 disks to a case without envelopes or labels. Please order only in increments of 100 units for quantity 100 pricing. With the exception of bulk pack, we are also willing to accommodate your smaller orders. Quantities less than 100 units are available in increments of 10 units at a 20% surcharge above our 100 unit price. **Quantity discounts** are also available. Order 300 or more disks at the same time and deduct 1%; 500 or more saves you 2%; 1,000 or more saves 3%; 2,000 or more saves 4%; 5,000 or more saves 5%; 10,000 or more saves 6%; 50,000 or more saves 7%; 100,000 or more saves 8%; 500,000 or more saves 9% and 1,000,000 or more disks earns you a 10% discount off our super low quantity 100 price. Almost all our diskettes are immediately available from CE. Our efficient warehouse facilities are equipped to help us get you the quality product you need, when you need it. If you need further assistance to find the flexible diskette that's right for you, call the appropriate manufacturers compatibility hotline telephone number listed at the bottom of this ad. **Dealer Inquiries Invited.**



## 3M diskettes for as low as \$1.94 each

3M Part #	CE quant. 100 price per disk (\$)
8SSSD	1.94
8SSSD-32	1.94
8SSDD	2.49
8SDDD	3.14
8SDDD-1024	3.14
5SSDD-RH	1.94
5SSDD-10RH	1.94
5SSDD-16RH	1.94
5SDDD-RH	2.69
5SDDD-10RH	2.69
5SDDD-16RH	2.69
5SSDD-96RH	2.79
5SDDD-96RH	3.74
5APPLE-FW	4.34

### Lifetime warranty

For more info on 3M call

**800-328-9438**  
In Minnesota 612-736-9524

## Memorex diskettes for as low as \$1.94 each

Memorex Part #	CE quant. 100 price per disk (\$)
3062	1.94
3015	1.94
3090	2.49
3102	3.14
3104	3.14
3481	1.94
3491	2.69
3501	3.74

### 5 year warranty

For more info on Memorex call

**800-538-8080**  
In California 800-672-3525

## Burroughs diskettes for as low as \$2.09 each

Burroughs Part #	CE quant. 100 price per disk (\$)
FD-101	2.09
FD-105	2.09
FD-108	2.64
FD-109	3.29
FD-110	3.29
FD-111	3.29
FD-112	3.29
MFD-11	2.09
MFD-12	2.09
MFD-13	2.09
MFD-14	2.84
MFD-15	2.84
MFD-16	2.84
MFD-20	2.94
MFD-23	3.89

### 1 year warranty

For more info on Burroughs call

**800-448-1422**  
Monday-Friday 9am-4pm ET

## Dysan diskettes for as low as \$2.99 each

Dysan Part #	CE quant. 100 price per disk (\$)
800501	2.99
800618	2.99
800605	3.89
800803	4.59
800839	4.59
801184	2.99
801186	2.99
801185	2.99
801187	3.19
801014	3.19
801188	3.19
802060	3.89
802062	3.89
802061	3.89
800439	3.89
802067	4.49

### 1 year warranty

For more info on Dysan call

**800-552-2211**  
In California 408-970-6096

## Buy your diskettes from CE with confidence

To get the fastest delivery from CE of your computer products, we recommend you phone your order directly to our Computer Products Division and charge it to your credit card. Be sure to calculate your price using the CE prices in this ad. Written purchase orders are accepted from approved government agencies and most well rated firms at a 30% surcharge for net 30 billing. For maximum savings, your order should be prepaid. All sales are subject to availability, acceptance and verification. All sales are final. All prices are in U.S. dollars. Prices, terms and specifications are subject to change without notice. Out of stock items will be placed on backorder automatically unless CE is instructed differently. Minimum prepaid order is \$50.00. Minimum purchase order \$200.00. All shipments are F.O.B. CE warehouse. No COD's. Non-certified and foreign checks require bank clearance.

For shipping charges add \$8.00 per 100 diskettes and/or any fraction of 100 8-inch diskettes, or \$6.00 per 100 diskettes and/or any fraction of 100 5 1/4-inch mini-diskettes. For cleaning kits, add \$3.00 per kit. For tape data cartridges, add \$1.00 per cartridge. For envelopes, add \$3.00 per pack of 100 envelopes. For printers add \$20.00 each for U.P.S. ground shipping and handling in the continental U.S. For Canada, Puerto Rico, Hawaii, Alaska, or APO/FPO delivery, shipping charges are three times continental U.S. rates.

**Mail orders to:** Communications Electronics, Box 1002, Ann Arbor, Michigan 48106 U.S.A. If you have a Visa or Master Card, you may call and place a credit card order. Order toll-free in the U.S. Dial 800-521-4414. In Canada, order toll-free by calling 800-265-4828. If you are outside the U.S. or in Michigan dial 313-973-8888. Telex anytime 810-223-2422. Order today. Copyright ©1983 Communications Electronics™ Ad #102783

**COMMUNICATIONS ELECTRONICS™**

## Computer Products Division

818 Phoenix □ Box 1002 □ Ann Arbor, Michigan 48106 U.S.A.  
Call TOLL-FREE 800-521-4414 or outside U.S.A. 313-973-8888





# SATELLITE/TELETEXT NEWS

GARY ARLEN  
CONTRIBUTING EDITOR

## FCC VOTES ON BROADCAST TELETEXT

The Federal Communications Commission has adopted an "open environment" teletext policy, clearing the way for U.S. broadcasters to start commercial teletext services. NBC and CBS have already begun feeding national teletext databases down their networks—but it may be a year or more before decoders and circuit boards are available to permit widespread reception of the teletext signals.

The FCC ruling did not deal with technical standards for teletext. Among the controversial aspects of the FCC decision is the authorization to allow broadcasters to offer any type of teletext service they choose, including private, closed-user or pay-teletext transmission intended only for specific audiences, rather than for all TV-set owners. TV stations can sell or lease the teletext vertical-blanking-interval lines to outside organizations or they may set up separate subsidiaries to offer teletext.

Another aspect of the FCC's teletext ruling is that is certain to generate further legal maneuvering is the decision not to require cable TV systems to retransmit broadcast teletext along with conventional TV programs on the same channel. The only exception comes if the teletext material is directly related to programming, such as back-up information or captions tied into the TV show.

The FCC ruling will allocate about 25% of the VBI to teletext: lines 14 to 18 and line 20; line 21 will remain dedicated to closed captioning. In 1988 the FCC will reexamine teletext, possibly opening lines 10 to 13 for teletext use.

## HEADLINE NEWS

Keycom Electronic Publishing will package a news service as the information segment of Control Video Corp.'s online "Gameline" system. The Keycom feed will begin late this year. Control Video offers a roster of services (mostly downloaded videogames) through Atari videogame consoles equipped with CVC's "Master Module." Users can pick headlines and news stories by manipulating the videogame controller to pinpoint items they want to read on the quasi-videotex service.

## TELETEXT SERVICE UPGRADED

Time Video Information Services' cable-teletext test will be upgraded late this year to include new telesoftware and an audio feature which will enhance videogames and other material by providing a synthesized voice to accompany on-screen actions. In addition, Time is adding software to allow scrolling of headlines in a 30-second cycle. Another new feature will allow users to program frames of specific interest so that information is automatically sequenced whenever a customer turns on the Time teletext service. During the next test phase (continuing in Orlando and San Diego) a printer will be provided to some users allowing them to get a paper copy of certain teletext data.

## EQUIPMENT HIGHLIGHTS

The latest proliferation of satellite equipment continues the trend toward lighter, lower priced and special-application devices. Among recent items of special interest:

**KLM Electronics'** new **X-11** parabolic antenna and polar-trak mount features slide-in screen panels and aluminum support ribs. A motorized model with remote control console features a low-voltage DC motor. (KLM, PO Box 816, Morgan Hill, CA 95037.)

**Winegard** has two new earth-station packages: model **SC-5000** includes an eight-foot spun-aluminum antenna, polar mount with button-hook feed, and a 130° LNA. The **SC-5007** is upgraded with a 100° LNA and an azimuth adjustment jack with a turnbuckle adjustment. A new Winegard receiver (model **SC-7032**) features a digital channel-selector readout and fine-tune control and automatic polarity switching. (Winegard Co., 3000 Kirkwood St., PO Box 1007, Burlington IA 52601)

**Regency Electronics** has introduced a \$595 Polaris **SA 9000** antenna, a deep-profile satellite dish with a 90-inch diameter and lightweight construction. The dish has a buttonhook feedhorn, Chapparral polarotor, polar mount, and a post mount option. (7707 Records St., Indianapolis, IN 46226).

**Dexcel** now offers a **DCR-4000** Low Noise Block Converter which can convert signals using a frequency synthesizer at the antenna. The receiver uses a 510 MHz PLL demodulator and a saw filter for better frequency response, phase response, linearity, and signal-to-noise ratio. (Dexcel, 2285 Martin Ave., Santa Clara, CA 95050.)

R-E

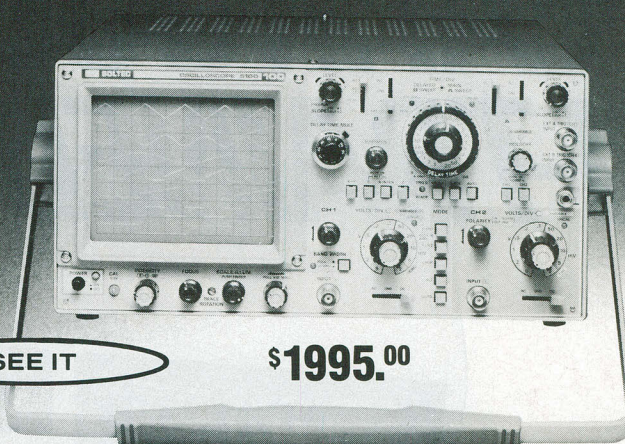


# SOLTEC®

## DESIGNER'S NOTEBOOK

### 100 MHz OSCILLOSCOPE MODEL 5100

- 4 Channels / 8 traces
- Fast sweep speeds from 2nS/DIV
- Dual Time Base
- High sensitivity from 2mV/DIV
- Glass epoxy circuit boards
- 15,000 MTBF
- Brilliant intensity, domed-mesh CRT
- Patented AUTO-FIX circuit for easy triggering
- Jitter-free trigger circuit
- Two year parts and labor warranty



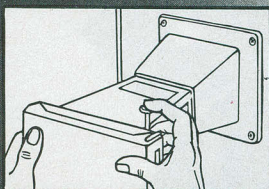
SEE IT

\$1995.00

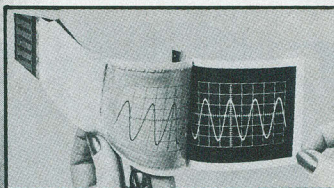


SHOOT IT

\$397.00



Available hand-held or bezel mount



### OSCILLOSCOPE CAMERA MODEL 7000

- Fits all Oscilloscopes and most Logic Analyzers
- Can be hand-held or mounted
- Uses standard Polaroid® film
- Variable aperture control: f3.5 - f32
- Variable shutter speeds: 1 second to 1/125th & B
- Built-in "X" contact for event triggering

### SCOPE MEMORY/WAVEFORM RECORDER MODEL VK12-2

- ... converts any oscilloscope into a storage scope
- ... permits acquisition of analog data with any computer

- Storage adapter for any oscilloscope with external trigger input
- Permits recording of high speed measured values with strip chart recorders.
- Amplitude resolution of 8 bits = 256 steps
- Maximum clock rate 2 MHz, permits storage of analog signals up to 300 kHz
- Parallel operation possible
- Pre-trigger switchable in steps for recording the "history" of a trigger event
- Built-in linear interpolator which can be switched off
- Memory capacity 2000 bytes
- Digital data input and output
- Optional IEEE-488 interface
- Strip chart recorder output.



CAPTURE IT

\$1495.00

ASK FOR IT

## SOLTEC®

### CORPORATION

11684 Pendleton Street • Sun Valley, California 91352  
(213) 767-0044 • TELEX: 67-4188  
TOLL FREE 800-423-2344 Outside California

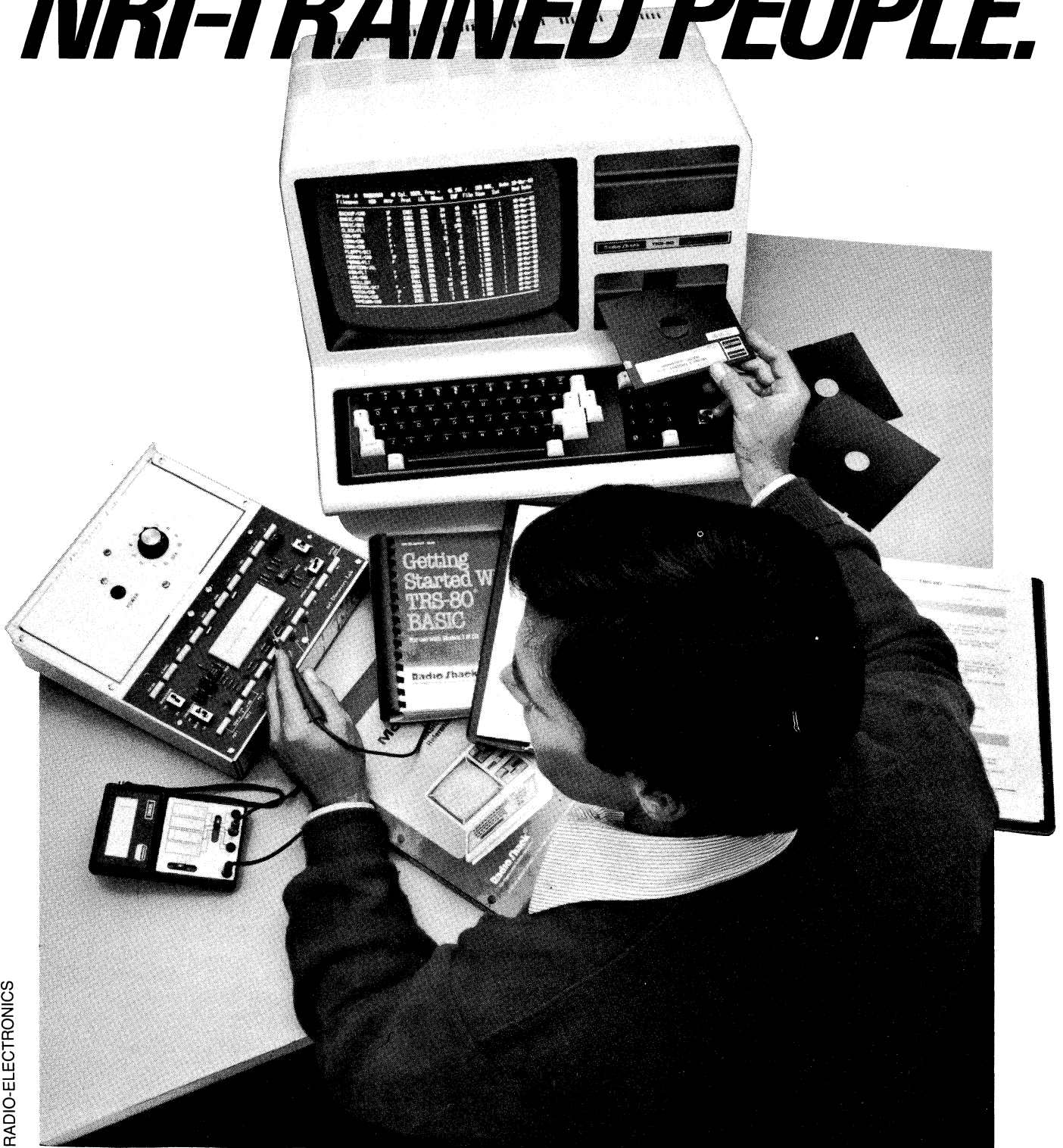
OSCILLOSCOPES

SCOPE CAMERAS & PROBES

DIGITAL WAVEFORM RECORDER



# ***COMPUTERS ARE CREATING JOBS FOR NRI-TRAINED PEOPLE.***





**IF YOU'RE SERIOUS  
ABOUT MAKING  
MONEY IN MICRO-  
COMPUTERS, NRI  
IS SERIOUS ABOUT  
SHOWING YOU HOW.**

The U.S. Department of Labor projects job openings for qualified computer technicians will soon double. International Resource Development, Inc., estimates a 600% increase in these jobs in a decade. And most of these will be new jobs, created by the expanding role of computers.

**NEVER HAS THERE  
BEEN A FASTER-  
GROWING FIELD  
OF TECHNOLOGY.**

Many people are afraid of losing their jobs to computers, but thousands of jobs will be created for those who are prepared to meet the challenge.

With NRI training, you'll be prepared. You can have a profitable, exciting future as an expert who can handle the operational, programming and technical aspects of all kinds of microcomputers and microprocessors.

**LEARN IN YOUR SPARE TIME.**

NRI trains you in your own home, at your convenience...no classroom schedule to meet, no need to quit your job. As a class of one with complete course materials and the backing of a staff of professional electronics instructors, you'll get extraordinary hands-on training on the latest model in the most popular line of microcomputers: the new TRS-80™ Model 4, with disk drive for greater memory capacity. The TRS-80 Model 4 complete with advanced features

TRS-80 is a trademark of the Radio Shack division of Tandy Corp.



*Your NRI course will include the new TRS-80 Model 4 with Disk Drive or the TRS-80 Color Computer with NRI Computer Access Card...plus a professional LCD multimeter, NRI Discovery Lab and hundreds of demonstrations and experiments. It's all yours to keep.*

that are built right in...features that are offered as options on other microcomputers. Designed to perform diverse personal and business functions and to accept the most software, the TRS-80 Model 4 is a great computer to learn on...and it's yours to keep, along with the disk drive!

**LEARN HOW TO USE,  
PROGRAM AND SERVICE  
STATE-OF-THE-ART  
MICROCOMPUTERS.**

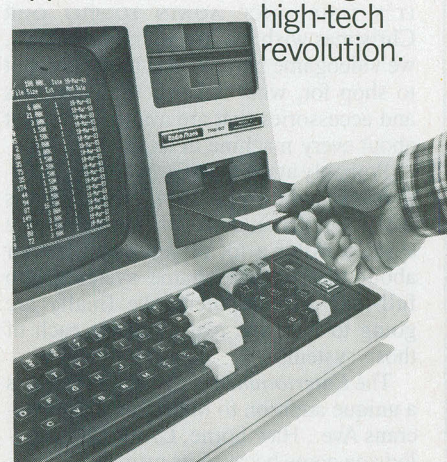
Through your carefully designed NRI course, you'll get a wealth of practical experience. You'll build circuits...from the simplest to the most advanced ...with your NRI Discovery Lab.® You'll use a professional 4-function LCD digital multimeter for analysis and troubleshooting.

With NRI training you'll explore your computer's registers, memory and input-output ports. You'll even write programs to control the circuits you've designed and built. You'll perform hundreds of challenging experiments, always backed by a full-time faculty ready to help you personally.

When your NRI training is complete, you'll be a computer technician, ready for your first job — servicing, testing or programming all types of microcomputers — in a rewarding and challenging new career.

**THE CATALOG IS FREE.  
THE TRAINING IS  
PRICELESS.**

Send the postpaid card today for your FREE 104-page catalog. It's a valuable guide to opportunities and training in the high-tech revolution.



*For greater computer memory capacity, a double density disk drive is included.*

You'll see how easily you become part of the growing high-tech world of microcomputers.

If the card has been removed, please write to us today.



**NRI School of Electronics**  
McGraw-Hill Continuing  
Education Center  
3939 Wisconsin Avenue  
Washington, D.C. 20016

**We'll give you tomorrow.**



# VIDEOGAMES

## Holiday shopping

DANNY GOODMAN

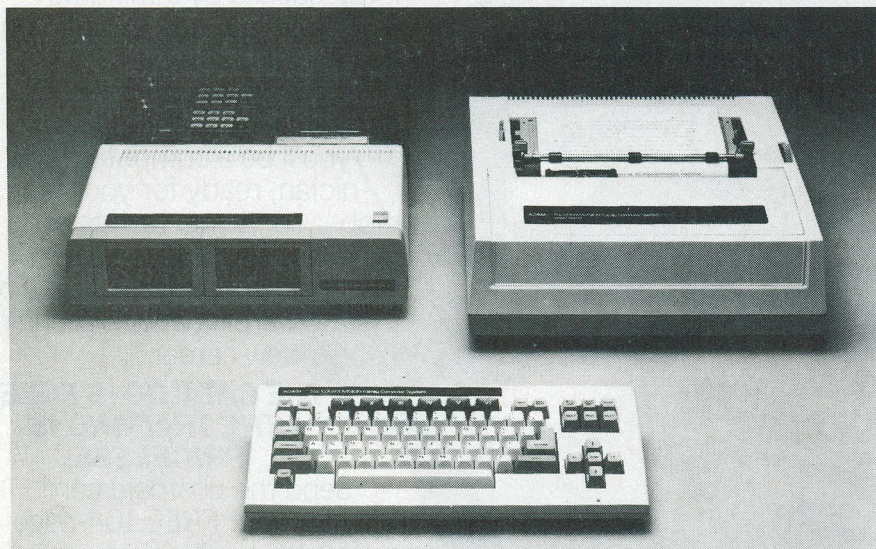


FIG. 1

IT'S TIME ONCE AGAIN TO PUT OUR Christmas wish lists in order. Fortunately, we videogame players are a pretty easy lot to shop for, what with all the cartridges and accessories that are available for just about every machine in captivity.

Probably at the top of every 2600, *Intellivision*, and *ColecoVision* owner's list is the computer add-on for the respective system. After a lot of years and hot air about turning videogame systems into full-fledged computers, we finally are going to have the real thing for each of those systems.

The *Entertainment Computer System* is a unique addition to Mattel's (5150 Rosecrans Ave., Hawthorne, CA 90250) *Intellivision* game because its primary focus is on extending the entertainment possibilities of the console. Music aficionados will want the piano keyboard and music recording/playback software before the computer keyboard. Yet with the latter, you can learn some of the basics of programming game graphics and sound.

*Coleco's* (945 Asylum Ave., Hartford, CT 66105) computer add-on, shown in Fig. 1, is more substantial in the realm of personal computers. The value-packed system includes a very powerful computer module with mass tape storage, a letter-quality daisywheel printer, and a few excellent software programs thrown in for good measure. (*Coleco's Adam* is essentially the same machine). While \$450 may

seem like a lot of money, it buys a real computer system that won't need a bunch of further add-ons to become a serious machine. At the same time, the computer gives the games player the ability to play *Coleco's* line of Super Games, with more play screens than many original arcade games.

Owners of the *Vectrex* self-contained videogame from GCE (233 Wilshire Blvd., Santa Monica, CA 90401) will surely want to experiment with the new lightpen. It's only about \$40 and comes with a special graphics cartridge that lets you draw on the screen with the pen and perform some elementary animation. Other light pen cartridges include music and geography learning tools plus a more sophisticated animation package.

Over at Atari, roller-ball controllers are new on the scene. Some may opt for Atari's unit, but the Zircon (475 Vanell Way, Campbell, CA 95008) *Trackball Controller* (\$30) has two fire buttons for left and right-handed players as well as a built-in adjustable rapid-fire control. And for rapid firing on regular joystick controllers, the \$13 *Blaster* from Questar Controls (670 NW Pennsylvania Ave., Chehalis, WA 98532) is a simple little module that plugs in right at the connector on the console. A variable control allows firing up to 20 shots per second. That'll save wear on the thumb.

If you own a 2600 and don't have a Starpath *Supercharger* yet, let Santa know. That \$45 plug-in addition to the 2600 will give you some of the best games playable on that system with graphics resolution that rivals that of the 5200 and *ColecoVision*. Games are loaded in from cassette tapes; and some games progress through three or more loads into several levels of play. You're missing half the fun if you don't have one.

Coleco is adding all kinds of accessories for its unit, but one of the most functional comes not from Coleco, but from Zircon. It's called the *Port Expander* and plugs into one of the controller jacks on the console. It allows you to keep the original *ColecoVision* controller attached while you also plug in any other Atari-compatible joystick controller that suits your fancy. That way you have the numeric keypad readily available for selecting game level and restarting. For only \$10 each, the *Port Expander* makes an excellent stocking stuffer for the Coleco addict.

To all our readers, best wishes for the holiday season.

### Imagic's No Escape for Atari 2600



CIRCLE 101 ON FREE INFORMATION CARD

Imagic	No Escape									
GRAPHICS										
SOUND										
EASE OF LEARNING										
CHALLENGE										
VALUE										
	1	2	3	4	5	6	7	8	9	10
	Poor		Fair		Good		Excellent			

continued on page 22





# Built for the Road.

**Introducing the Bearcat® 260.** There have always been tabletop scanners that you can hook up to your car—one way or another. But now comes the first Bearcat Scanner *designed* for mobile use. Designed as a tool—not a toy.

**It's easier to use.** Because the people who use it have other things to worry about. Mount the compact Bearcat 260 on the hump or under the dash. Either way, every control is in easy reach. The keyboard is even illuminated for easy visibility in darkness.

**It's easier to hear.** Front-facing speaker and three full watts of power let you hear the Bearcat 260 above the engine—even at speed.

**It's built to take it.** The Bearcat 260's heavy metal case keeps it going when the going gets rough.

**It's a Bearcat Scanner.** And that means all the latest technology—including 8-band coverage and 16 channel capacity. Priority channel. Weather bulletins at the push of a button. Automatic and manual search. Lockout. Direct channel access. Automatic squelch. There's even an external transformer and telescoping antenna for home use.

**No stay-at-home scanner can do what the Bearcat 260 does.** So take it with you. And stay on top of the action. To find the address of your nearest Bearcat Scanner Dealer, call 1-800-S-C-A-N-N-E-R.

---

*SCAN's 30,000 members know what others miss! Insider news. Frequency info. Tech tips. Awards. SCAN Magazine and more. Send \$10 for a 1-year membership to the Scanner Association of North America, 111 East Wacker Drive, Chicago, IL 60601.*

---

*The use of this radio in a motor vehicle may be regulated or require a permit in certain states.*

---

**BEARCAT®  
SCANNERS**

**Electra** Electra Company  
Division of Masco Corp. of Indiana  
300 East County Line Road  
Cumberland, Indiana 46229  
©1983 Masco Corp. of Indiana



CIRCLE 74 ON FREE INFORMATION CARD



# VIDEOGAMES

continued from page 20

While there have been dozens of games for the 2600 in which the player controls a missile-generating object across the bottom of the screen to shoot objects hovering above, *No Escape* from Imagic (981 University Avenue, Los Gatos, CA 95030) is a refreshing, new approach to the old action.

In that game, which uses a theme based on Greek mythology, one or two players (alternately) control "Jason" across the screen bottom with the joystick. He is inside a temple, the roof of which consists of several layers of colored bricks supported by columns at each side of the screen.

Scooting between Jason and the temple roof are as many as six "Furies" at a time. Jason, fortunately, has an endless supply of stones—but, to make life difficult, he can't hit the Furies directly.

To kill off each wave of Furies, Jason must hurl a stone to the temple roof, loosening a brick from it. The gently falling brick must land on one of the Furies for the demon to disappear. A direct hit with a stone brings an extra Fury back to life. That kind of bank shot is no easy feat, especially on higher levels. That's because at those higher levels the Furies are significantly more erratic in their behavior. Plus, as the waves get more intense, the Furies start stoning Jason.

Jason has a limited number of lives, as shown by a relative lifeline on the screen. As he finishes each wave, his lifeline increases. But hits by the Furies or his own bricks subtract from his total.

Every two waves, the type of Fury changes. Our personal favorite is the griffon-looking one in waves 3 and 4. Building onto the intensity of each wave is a more ominous sound repetition until all Furies are gone.

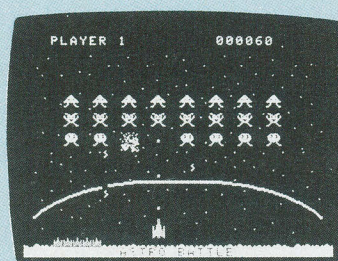
The skill involved in mastering *No Escape* is considerably more than simple hand-eye coordination. In some waves you must anticipate the moves of the Furies. In others, you have a modest amount of control over them because they rush toward your side of the temple after you hurl a stone. With careful planning, you can time a second shot so that you draw the Furies into a falling brick from the first shot.

Yet you must always be on the lookout for the stones the Furies are hurling. At higher levels, they come fast and from

quite a long distance, not giving you much time to figure out a strategy while constantly in defensive motion, furiously avoiding the falling bricks.

*No Escape* is not a complex game to learn, but it is no pushover in the long run. The game play may not have the broad appeal of Imagic's legendary *Demon Attack*, but for something completely different in a shoot-'em-up game, this effort is worth a try.

## Coleco's Gorf for ColecoVision



CIRCLE 102 ON FREE INFORMATION CARD

Coleco	Gorf									
GRAPHICS										
SOUND										
EASE OF LEARNING										
CHALLENGE										
VALUE										
	1	2	3	4	5	6	7	8	9	10
	Poor		Fair		Good		Excellent			

We'll be honest up front and say that we never cared much for *Gorf* when it was in the arcades; it just seemed like a rehash of the old *Space Invader*/*Galaxian* themes. But when it comes to the *ColecoVision* version, well that's another story.

For those of you who have not seen the very popular *Gorf* in the arcades, let's go over the fundamentals. The game is essentially four different games in one, each a different kind of outer space shoot-'em-up. The first one, "Astro Battle," is indeed very much like *Space Invaders*, but

with only three rows and eight columns of aliens.

Moreover, your space fighter at the bottom of the screen has two advantages: a one-way shield that blocks the first enemy bomb at each spot, and vertical as well as horizontal movement inside the shield. Both allow experienced players to get a jump on the enemies while they're still frolicking back and forth at a slow speed.

The second game is "Laser Attack," a free-form version of *Galaxian*. One formation (at higher levels there are two) consisting of a laser ship and robot ships move rhythmically, but erratically across the sky. The laser ship occasionally lets fly a deadly blast. Again, your job is to eliminate all aliens.

In the third game, "Space Warp," robot ships come swirling out of the center of the screen (supposedly a tunnel) shooting off radiation bombs at you. It's not easy hitting a target going around in spirals. And the last game, called "Flag Ship," pits you against a mother ship and its missiles. Now, however, the shield is one-way in favor of the flag ship, so you must first blast your way through and then aim very carefully for the precise spot that destroys the ship's internal reactor, blowing the ship to smithereens in a very colorful video display.

Even with four games in one, experienced home game players might get bored with a repetition of the same four games. But two elements of the Coleco version keep us coming back for more. First of all, succeeding levels increase noticeably in difficulty. Anything that moves, moves faster; anything that shoots, shoots more accurately.

Secondly, at the successful completion of each level, you are promoted to a new rank. To us, the actual score is not as important as the rank you achieve and the number of missions (game screens) you complete. Unlike many other games of that type in which you shoot away for higher points, Coleco's *Gorf* gives you something more to hang onto than just a number.

Unfortunately with a game of such simple ancestry, the graphics execution on the Coleco edition is nothing very exciting, except perhaps the destruction of a flag ship. But unexciting graphics aside, it still beats any other version we've seen, including the original.

R-E



# Amazing new solid-state oscilloscope... fits in the palm of your hand

## CRT oscilloscopes just became obsolete!

The revolutionary new solid-state digital LED Pocket-O-Scope does it all, in a 4-ounce package you can put in your pocket.

**Easy to use.** Ideal for the hobbyist or the technician. The Pocket-O-Scope is 100% solid-state, focus and brightness on the 210 point, high-intensity illuminated screen are *electronically* self-controlled. The trace is *always* in sharp focus. Zero and sweep positions are maintained automatically. Zero-reference, or cross-over line is always centered for full trace minimum on the screen. Automatic internal circuitry always assures a properly positioned wave form.

**4 solid-state controls do it all.** The only knobs on the Pocket-O-Scope are for positive and negative sensitivity and for coarse and fine synchronization of the frequency of the incoming signal. The easiest to use, full capability scope available!

**Years in development.** The Pocket-O-Scope is the culmination of years of development in high technology, micro-electronic components and digital design.

**Features:** All solid-state, digital design • Hand-held or bench operation • High resolution 210 point, 1.5" square display • Battery or A/C operation with adapter • Factory calibrated – *never requires recalibration* • Full function, single trace capability plus 1/2 channel dual trace and signal inverter • Full

overload protection to prevent damage to scope

• Automatic zero voltage centering • Automatic free run or locked image • Automatic full horizontal sweep circuit • External input/output for add-on capability

### Specifications:

5 Megahertz bandwidth • Sensitivity – vertical, 10MV •

Accuracy  $\pm 3\%$  on

wave forms – sweep linearity  $\pm 5\%$  • Time base – .1 microseconds to .5 seconds

• Vertical gain – 0 to 120 volts • Continuous free run to locked image response • Power supply 9VDC – dual polarity **Controls:** Single or dual trace • On-off, battery-A/C • Sensitivity; separate pos. & neg. controls • Sync C & Sync F controls

### Limited, 90-day warranty

**No risk introductory offer.** The revolutionary Pocket-O-Scope is a development of Calvert Instruments, Inc., for 25 years a manufacturer of electrical equipment. As an introductory offer for a limited time only, you can buy the Pocket-O-Scope including a carrying case, A/C adapter, 3 standard "grabber" probes and 2 high voltage probes for only \$249.95, a \$321 value. If you act now, you will also receive FREE Calvert's 200-page Comprehensive Oscilloscope Training Manual, a \$15.95 value!

Put your Pocket-O-Scope to the test for two weeks. And if you decide, for *any* reason, that the Pocket-O-Scope is not for you, return it within the 14-day trial period for a prompt refund. The training manual will still be yours to keep.



**Mail this coupon today, or call toll-free\* while the introductory offer is still in effect.**

**Calvert Instruments, Inc.**

19851 Ingersoll Dr., Cleveland OH 44116 • 216-356-2155

### Please send me:

☐ Pocket-O-Scope(s), including carrying case, A/C adapter, standard and high voltage probes, and FREE training manual. (Batteries not included) all for \$249.95 plus \$5 for postage and insurance. Ohio residents add 6.5% sales tax.

☐ Pocket-O-Scope only with standard probes: \$179.95 plus \$5 postage. Ohio Residents add 6.5% sales tax.

☐ My check is enclosed.

☐ Please charge the credit card account checked below. (Fill in all account number digits of the *one* credit card you wish to use.)

☐ MasterCard ☐ Visa

RE-1283

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Expiration

Date

Interbank

No.

(MasterCard only)

Full signature

Name

(please print)

Address

Apt.

City

State

Zip

**\*CALL TOLL-FREE 800-835-2246 EXT. 118** to order by phone, request further information or to inquire about becoming a distributor. In Kansas, call 800-362-2421 Ext. 118. Allow 6-8 weeks for delivery.



Patent Pending

CIRCLE 7 ON FREE INFORMATION CARD



# LETTERS

Address your comments to: Letters, **Radio-Electronics**,  
200 Park Avenue South, New York, NY 10003

## CAR BURGLAR ALARM

In your "Car Burglar Alarm," (**Radio-Electronics**, May 1983), you presented a very effective and yet relatively simple design. You did, however, make what I consider to be a mistake when you advised hooking up the device so that it would get power from the car's battery. I realize that that is what most alarm installers do, but it is very easy to disable the device when it is hooked up in that manner.

From personal experience (regrettable), I have found that when planning to steal merchandise from a car, the first thing that many burglars do is to cut the battery cables, to disable any alarm; and that can be done from underneath the car, so as not to trip off any sensors.

I recommend that, if at all possible, the alarm be powered by a separate battery kept inside the car (a gel-cell or equivalent) that is

trickle-charged off the car's power system and isolated by way of a series diode so that it doesn't try to power the rest of the car's electrical system.

KENNETH C. FINNEY  
Graham, WA

## POCKET-SIZED SHORTWAVE RECEIVERS

In regard to the Danny Goodman article about pocket-sized shortwave receivers (**Radio-Electronics**, March, 1983), it should be pointed out that no special circuitry is required to obtain excellent SW reception. In fact, any of the modern pocket radios can be modified for that purpose. The modification can be accomplished in less than 30 minutes, at a cost of less than one dollar.

The only *basic* difference between a SW receiver and a regular broadcast-band AM radio is the tuned circuit. With a simple modification, one can receive all the popular SW

stations, WWV, some of the ham frequencies, and nearby radio telephone transmissions. If you or your readers would like more details, write or call me. My address is 115 Manor Place, Santa Cruz, CA 85060; telephone: (408) 426-2149.

H. BAILEY

## SMOKING POTENTIOMETERS

This letter is in response to the one written by Mr. Campbell (**Radio-Electronics**, February 1983) concerning his potentiometer smoking as a result of using a VOM to test it. That phenomenon is hardly unknown, and can be caused by the VOM delivering excessive wiper current—as much as 0.5 A, reportedly. (See *The Potentiometer Handbook*, by C.D. Todd, McGraw-Hill 1975.)

While that isn't likely to occur with a modern, sensitive VOM, it is possible. Please note that the effect generally decreases by an order of magnitude as the ohms range is in-

# GET THE SAME VIDEO TRAINING THE PEOPLE AT SONY GET.

Now you can be trained by Sony even if you aren't employed by Sony.

Because we're making our vast library of training videotapes available to you. The very tapes that teach our own engineering, service and sales personnel.

The tapes cover the products and concepts of video and its related technologies. You can learn the basics of video recording. Color systems. Digital video and electronics. Television production. And more.

Plus you can learn how to service cameras, VTR's, and other video products. As professionally as Sony does.

The tapes are produced entirely by Sony and contain up-to-the-minute information. They communicate clearly and simply. And some of them are even programmed for interactive learning.

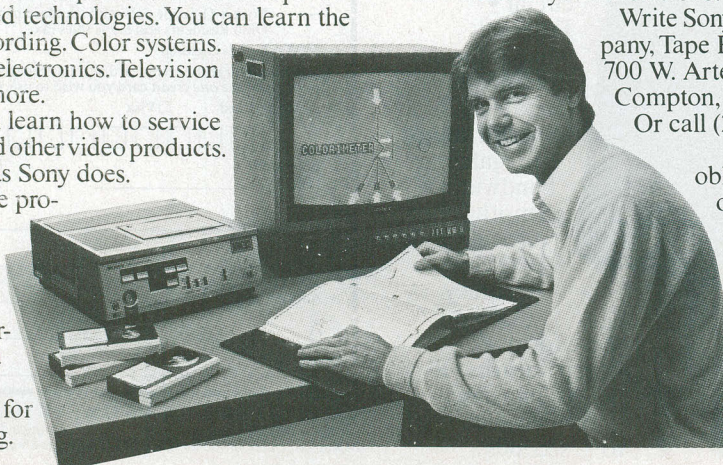
And learning through video can be done at your own pace, in the convenience of your home, shop or school. Reviewing is quick and easy. And the tapes are always available for reference.

Send for your catalog, which lists more than 250 titles. In your choice of 3/4" or 1/2" formats.

Write Sony Video Products Company, Tape Production Services, 700 W. Artesia Boulevard, Compton, California 90220. Or call (213) 537-4300.

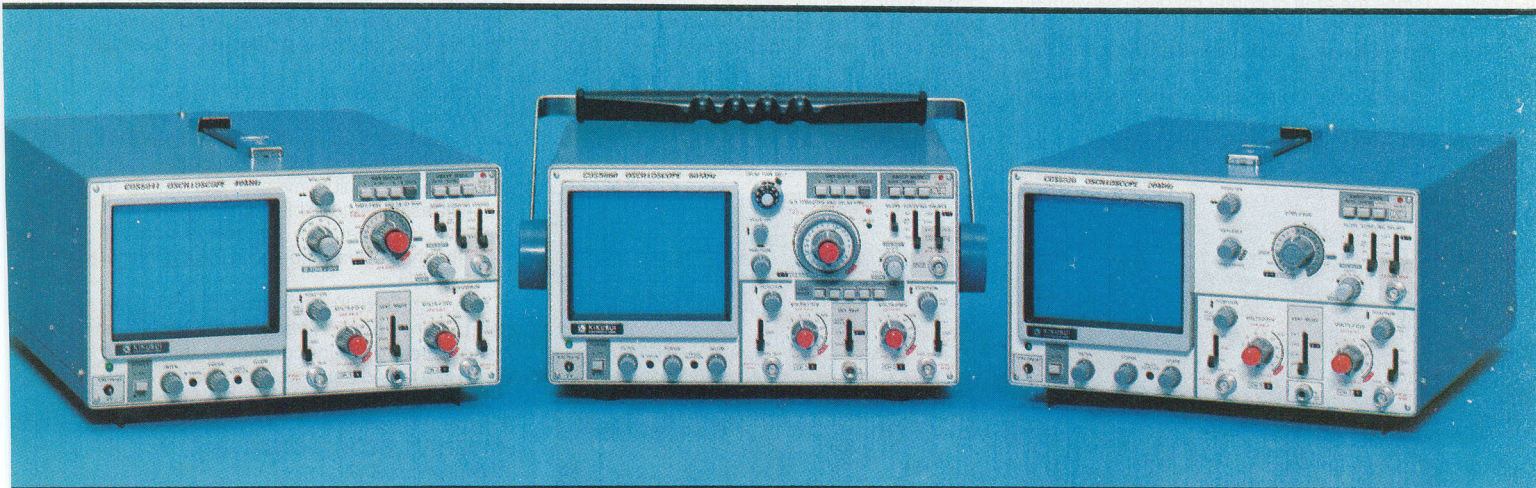
Of course, there's no obligation. Except the obligation you have to yourself: to find out about the best training available in one of the country's fastest-growing, most lucrative fields.

**SONY**  
Video Communications  
Sony is a reg. trademark of Sony Corp.





# The best 60MHz scope costs only \$1150. It's from Kikusui.



That's right. Only \$1150 for Kikusui's top-of-the-line 5060 model oscilloscope. And we also have four other scopes for as low as \$600 in our new 5000 Series.

Not only that, we're offering a two year warranty on each of them, compared to other big name companies' limited one year warranties.

When it comes to performance, our 5000 Series has the edge over the Tektronix 2200 Series in lab quality, chop frequency, and trigger view. Ours also have more display modes, higher acceleration for better brightness, and sharper focus for better resolution.

Each scope in our 5000 Series is crafted so that it can be used for production, field service, consumer electronics servicing, or even personal use. The 5060 is a 60MHz scope with 3 channels, eight traces, delayed sweep, delay line and alternate sweep, and priced at \$1100. Models 5040 and 5041 are 40MHz, dual channel scopes, featuring peak-to-peak automatic triggering, automatic focus control and a delay line. If you're interested in a 20MHz scope, we have our 5020 and 5021 models with features similar to our 40MHz scopes. Both the 5041 and 5021 also have delayed sweep. Prices at \$920 for the 5041, \$795 for the 5040, \$690 for the 5021 and \$595 for the 5020. So, whatever model suits you best, you can't get a better scope for the money.

Of course, there's a reason we're able to offer these bargains and quality. We're one of the biggest manufacturers of scopes in the world, with over 30 years in the business. Another reason is KIK's nationwide network of lab quality maintenance facilities.

Write us and we'll send complete specifications back to you. Or just take a little time to call us. It's a small price to pay to get big time quality and service.

For sales and technical information  
call toll free **800-421-5334**  
(in Calif., Alaska, Hawaii 213-515-6432).

Order Toll Free  
**800-421-5334**



17819 Figueroa Street  
Gardena, Calif. 90248  
TWX 910-346-7648

✻ In Canada call: Interfax Systems, Inc. 514-366-0392



Subsidiary of Kikusui Electronics Corp., 3-1175 Shinmaruko-Higashi, Nakaharu-Ku, Kawasaki City, Japan (044) 411-0111

**CIRCLE 48 ON FREE INFORMATION CARD**



creased each step. Thus if a 1 megohm potentiometer is being tested with a VOM, it may not be wise to use the "X1" or "X10" ranges. Inexpensive DMM's, especially the imported variety, also can deliver enough current to damage a high-resistance potentiometer. (Values up to 10 megohms are reasonably common, as up to 50 megohm potentiometers are available from some manufacturers.)

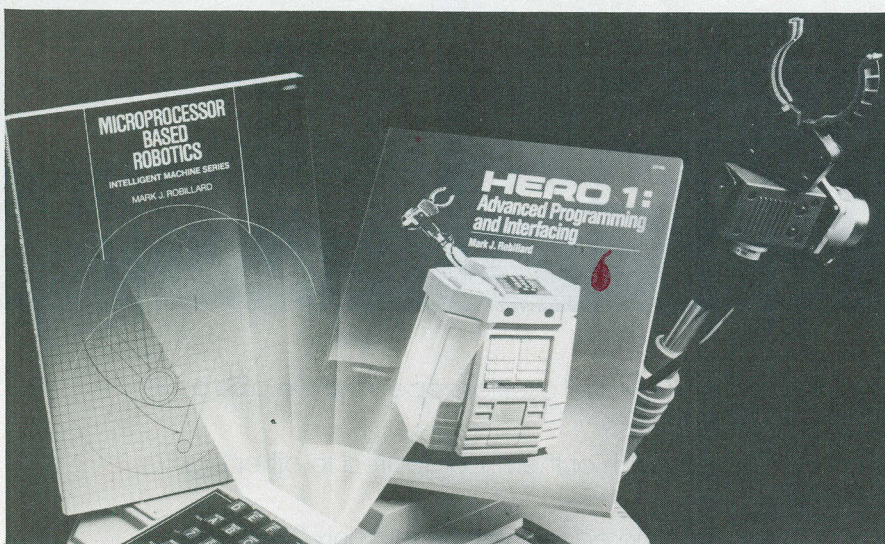
Even if the pot is not destroyed in a dramatic fashion, leaving an open element, it is possible to burn a small hole in the element (since the area of contact is often very small) and that will result in a noisier pot of slightly higher resistance that will actually open up as the wiper passes the burned zone. The above problems can also affect meter movements and a few fussy semiconductors. Oldtimers will recall the point-contact transistor of the

1960's that could tolerate only a very tiny power dissipation of perhaps 40 mW, as compared with 360 mW or more for the modern planar epitaxial devices. Fortunately, few active devices today are as fragile electrically. Further information on potentiometers can be found in the book I mentioned above.

SPEHRO PEFHANY,  
Milton, Ontario, Canada

### ON NIKOLA TESLA

As a well-satisfied subscriber to **Radio-Electronics**, let me add my compliments to you for your informative contributions to the memory of that forgotten genius, Nikola Tesla. The letters from other readers show that they are quite well informed, and the overview article by E.J. Quimby in your August 1983 issue was outstanding.



## GET A GRIP ON ROBOTICS WITH SAMS.

Grab onto these Sams Books from Mark Robillard and get a jump on robotics programming.

**MICROPROCESSOR BASED ROBOTICS** starts by explaining the mechanics of robot hands, arms and legs, and leads into tactile, motion and attitude sensing, even vision systems. Learn system controlling through microprocessors and BASIC programming, plus much more. It's an informative non machine-specific book that is an excellent introductory guide. No. 22050, \$16.95.

**HERO 1: ADVANCED PROGRAMMING & INTERFACING** moves beyond the technical manuals with a series of advanced experiments and applications. Discusses machine and robot language, building and installing both local and remote interfaces, operating system enhancements, and other select programming techniques. No. 22165, \$16.95.

**Program your own success by ordering these Sams Books today. Call 800-428-3696 or 317-298-5566 and ask for Operator 469.**

### SAMS BOOKS AND SOFTWARE

HOWARD W. SAMS & CO., INC.  
4300 West 62nd Street • P.O. Box 7092  
Indianapolis, IN 46206

HERO 1 is a trademark of the Heath Corporation.

Offer good in USA only and expires 3/31/84. Prices subject to change without notice. In Canada, contact Lenbrook Electronics, Markham, Ontario L3R 1H2. AD469

CIRCLE 32 ON FREE INFORMATION CARD

I have been associated with the electronics field for almost 30 years, 20 years of that in Naval Aviation electronics, and presently involved in computer-data communications. I am one of the very fortunate individuals in this world who enjoys working with my hobby: electronics.

Back during the 50's, I had the exciting experience of reading O'Neill's work, *The Prodigal Genius*. Since that time, the life and times of Nikola Tesla has been a continuing fascination to me. Over the years, my biggest question has been: How did it happen in America that the name "Nikola Tesla" is not a household word? He is a national hero to his fellow Serbians.

Thomas Edison was a semi-hero to America's young; however, the educators and history writers have surely missed their greatest opportunity in failing to promulgate the story of the greater genius inventor. But thanks to the increasing band of his admirers, and your magazine's cooperation, thousands more will have the thrill of learning about the exploits of Nikola Tesla.

Although O'Neill's book is out of print, Margaret Cheney's book, *A Man Out of Time* would make a great good introduction to those who would like to find out more about Tesla. Again my thanks to **Radio-Electronics** for helping to keep the memory of that great man alive.

ROBERT B. ESON, US Navt Ret.  
Westminister, CO

### AUTOMOBILE LOCATOR

In reference to the automobile locator ("New Ideas," **Radio-Electronics**, April 1982), I would like to offer the following comments. I tried the above-mentioned circuit myself, and a few of my friends experimented with it, too. We all reached the same conclusion: When R1 is set to 10K, the frequency output is 12 kHz. With the 10K pot set at 0, although the IC timer 555 had a tendency to heat up, the operating frequency was 72 kHz. The tuning range of the output tank with a 20-pF to 400-pF capacitor and 500  $\mu$ H to 1800  $\mu$ H coil is between 188 kHz to 1.59 MHz. With an 1800  $\mu$ H coil and 20-400-pF variable capacitor, the tuning range is 188 kHz - 839 kHz. Now there is a problem with the IC timer output of 12 kHz to 72 kHz, which falls below the tuning range of the author's circuit.

Also, I see a problem with the antenna-coupling capacitor of 47-pF with the IC timer output of 12 kHz. The capacitance reactance of the coupling capacitor is 282K ohms and with 72 kHz,  $X_c = 47K$ . Obviously, it will attenuate the signal transmission.

We found the following modifications appropriate: Capacitor C1 should be dropped to .001  $\mu$ F, and that will give an operating range of 120 kHz to 481 kHz. The tuning range of the output tank with 13-pF to 365-pF variable capacitor and 1800  $\mu$ H coil is from 196 kHz to 1.04 MHz; the capacitive reactance has also markedly decreased.

Please note the following manufacturer's data on the open-loop gain of the 741 operational amplifier:

1 KHz = 1000 or 60 db;  
10 KHz = 100 or 40 db;  
100 KHz = 10 or 20 db,  
1000 KHz = 1 or 0 db.

As you see from the above data, there is a serious attenuation of the received signal as the transmitter frequency increases.

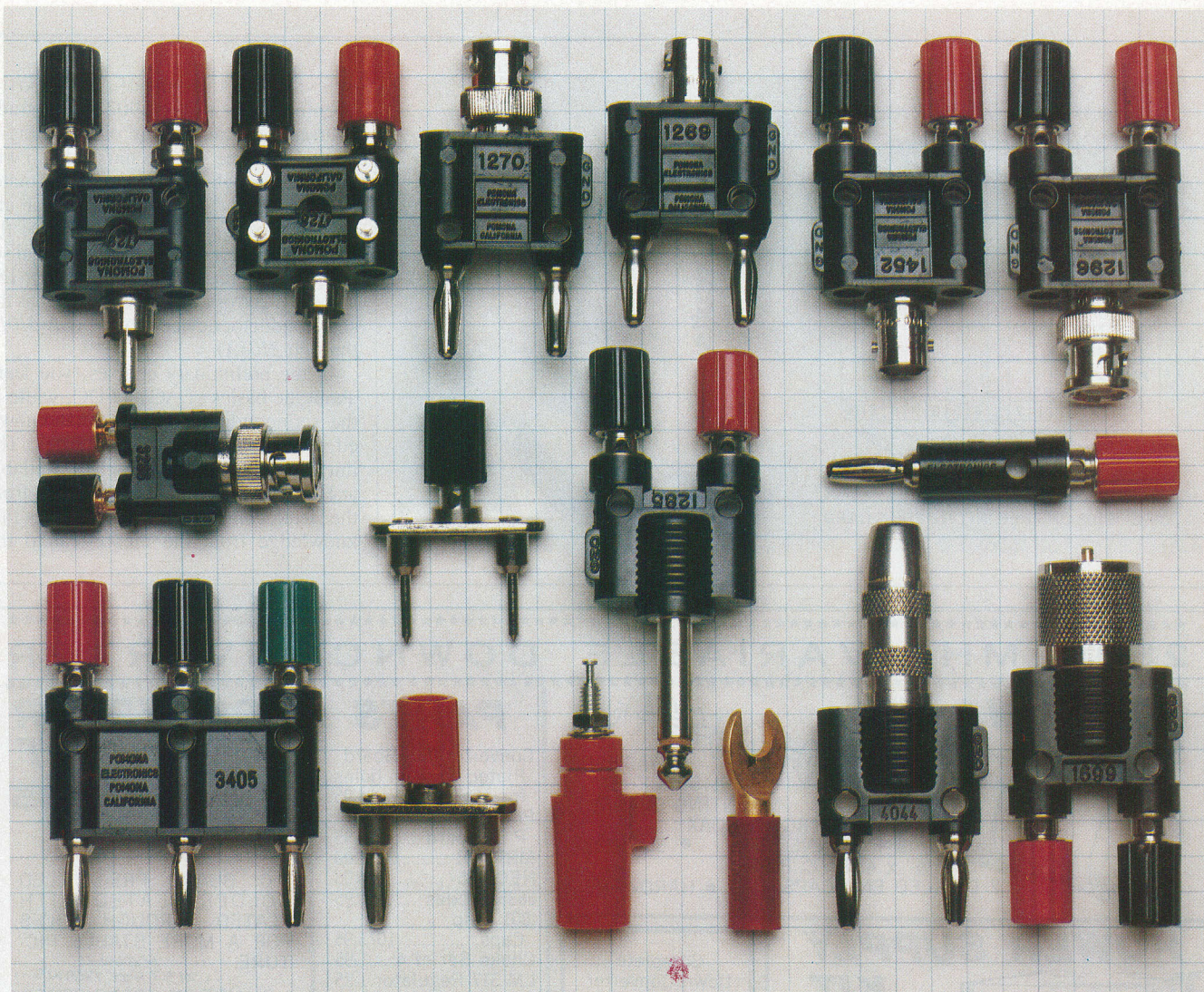
MOHINDER S. GOOMAR, M.D., F.R.C.S.  
Saratoga Springs, NY

R-E



# THE POMONA PROMISE

We provide the design engineer with the best  
adapters made in this country.  
Or anywhere.



When you come out and say that you make the best of something, you'd better be able to back it up.

We've been doing that for over thirty years.

We didn't start our business making adapters, but when the time came, we promised that our adapters would be superior.

Right now, if you questioned the professionals in the electronics industry, you'd discover we made good on that promise.

Today, we produce not only the best adapters you'll ever use,

but probably the widest selection you'll ever need. Almost 200 different combinations at last count.

At ITT Pomona Electronics, we know there is no such thing as standing pat. We also know that your needs change and your expectations become greater as the demands become more severe. To this end we will continue to create a better way. A better product.

That's a promise.

All of our products are described and illustrated in our General Catalog, and it's free. Just call (714) 623-3463 or 623-6751.

TWX 910-581-3822. Write to us at ITT Pomona Electronics, a Division of ITT Corporation, 1500 E. Ninth St., Pomona, CA 91766.

In Europe: ITT CANNON BELGIUM S.A./N.V. Rue Colonel Bourg Str. 105 Space A (B.3) 1140 Brussels, Belgium. Phone: 02-735-6094.

Our products are available through your favorite electronics parts distributor.

**ITT** Pomona Electronics

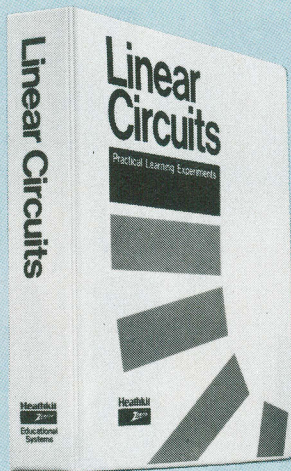


# EQUIPMENT REPORTS

## Heath EH-701 Linear Circuits Course

Heath	Linear Circuits Course									
OVERALL PRICE										
EASE OF USE										
INSTRUCTION MANUAL										
PRICE/VALUE										
	1	2	3	4	5	6	7	8	9	10
	Poor		Fair		Good				Excellent	

CIRCLE 103 ON FREE INFORMATION CARD



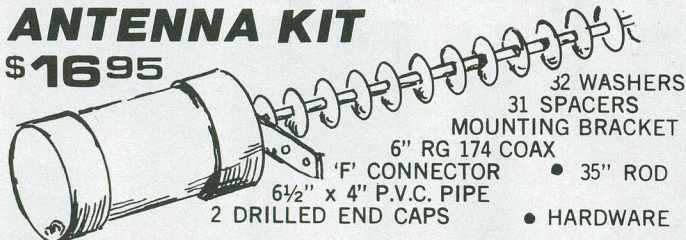
WHENEVER YOU BEGIN ONE OF HEATH'S (Benton Harbor, MI 49022) self-study courses, you can be sure of one thing—that by the time you are finished you will have a thorough knowledge of the material presented. Their *EH-701* linear circuits course is no exception. One of the modules in their hands-on educational series, it is an ideal follow-up to their DC and AC electronics courses, as well as the semiconductor devices course (*EE-3101A* through *3103A*).

In the preliminary courses, you learn about the basics of AC and DC, while in the semiconductor course, that knowledge is applied to various devices. The linear circuits course, which is available at Heathkit Stores or by mail order from the Heath company for \$49.95, takes that knowledge from the theoretical to the

## 2300 MHz VARIABLE DOWNCONVERTER

### ANTENNA KIT

\$16.95



32 WASHERS  
31 SPACERS  
MOUNTING BRACKET  
6" RG 174 COAX  
• 35" ROD  
6 1/2" x 4" P.V.C. PIPE  
2 DRILLED END CAPS  
• HARDWARE

### POWER SUPPLY KIT



\$16.95

POWER TRANSFORMER  
COURSE TUNE POT.  
FINE TUNE POT.  
3 'F' CONNECTORS  
RESISTORS & CAPS  
LED WITH HOLDER  
TERMINAL STRIP

P.C. BOARD  
RF CHOKE  
KNOB  
WIRE  
2 SWITCHES  
4 DIODES  
LM 317 REG.

WOOD GRAIN CABINET WITH SILK  
SCREENED front and back \$10.95 Extra  
BUILT POWER SUPPLY.....\$34.95

Complete  
Down Converter  
System  
INCLUDES  
ANTENNA KIT  
POWER SUPPLY KIT  
CONVERTER KIT  
**SPECIAL \$49.95**

**QUANTITY DISCOUNTS**  
Any Price in Adv.

10 pcs.	12% off
25 pcs.	18% off
50 pcs.	25% off
100 pcs.	30% off
1000 pcs.	35% off

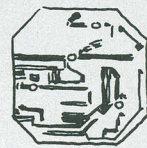
No Mixing for  
Quantity Discount

### PARTS

Converter P.C. Board  
Plated through holes  
for stability.....\$4.95  
Power Supply  
P.C. Board .....2.95  
MRF 901 .....2.00  
NEO2135 .....4.95  
2835 Diodes ..... .95  
.001 Chip  
Caps. .... 10/3.95  
Choke Set of 4.....1.95  
LM 317 Regulator 1.25  
'F' Connectors  
Chassis ..... .50  
Wall Transformer  
12 VAC 700 MA....4.95  
'U' Bolt ..... .95  
BALUN  
75 to 300 ohm.....1.95  
BALUN  
for rabbit ears...2.95  
\*RG 59/U COAX  
WITH CONNECTORS  
FACTORY MADE  
100 Ft. .... \$17.50  
50 Ft. .... 9.50  
25 Ft. .... 5.75  
3 Ft. .... 2.50

### CONVERTER KIT

\$16.95



P.C. BOARD PRE-DRILLED  
SOLDER PLATED WITH  
PLATED THROUGH HOLES  
FOR A MORE STABLE PICTURE.  
NEW!!  
... 2137 HOT TRANS...

3 MRF 901 TRANSISTOR  
2 HP 2835 Diodes  
6 .001 Chip Caps.  
9 Resistors  
4 Prewound chokes  
1 Electrolytic Cap.  
1 Pre Made Probe



★ WIRED P.C. BOARD TESTED,  
READY TO CONNECT TO  
CAN WITH PROBE & CABLE  
CONNECTOR ATTACHED.  
\$24.95

We will tune converter board for \$12.50  
trouble shoot  
add .....7.50  
trouble shoot  
power supply..\$12.50  
plus any parts needed.

We will accept telephone orders for Visa & Mastercard  
No C.O.D. Orders

To Order Call 800-428-3500 317-291-7262  
Complete Kit Weighs 10 pounds. Please add Sufficient Postage  
6254 La Pas Trail  
Indianapolis, Indiana 46268

## ELECTRONIC RAINBOW





# Micro-Professor



**MPF-I PLUS**

- A complete microcomputer system
- Detailed instruction manuals
- A full range of options and accessories
- For instructional use, plus a wide range of practical applications

## Learn Computing with the Micro-Professor-IP for \$199

The Micro-Professor (MPF-IP) is a complete hardware and software system that will expose you to the amazing world of microprocessors.

A comprehensive teaching manual gives you detailed schematics and extensive examples of program code. All of this makes for a superb learning tool for students, hobbyists and microprocessor enthusiasts alike. Also serves as an excellent teaching aid for instructors of electrical engineering and computer science.

With the Micro-Professor-IP you get:

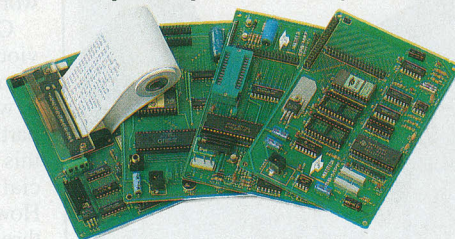
- Z-80 processor chip
- High quality 49-key keyboard
- On board 4 K-byte RAM
- On board 8 K-byte ROM including:
  - Interactive Monitor
  - Line Assembler
  - Two Pass Assembler
  - Tekit Editor
  - Disassembler
  - Language options of BASIC and FORTH.

You'll also get a lot more including:

- Built-in speaker
- 20 digit alphanumerical green tube display.
- 48 Input/Output lines
- Battery back-up circuits for RAM
- Bus expandable Z-80\* architecture
- Three user's manuals
- Program storage/reading cassette interface

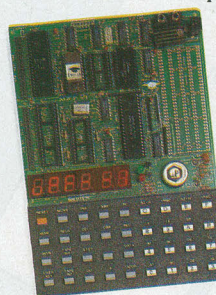
### Options

- Student Workbook(\$15)
- Printer(\$99)
- Speech Synthesizer Board(\$129)
- Sound Generation Board(\$99)
- EPROM Programming Board(\$169)
- Input/Output and Memory Board(\$99)



### MPF-I Micro-Professor

Z-80\* CPU, 2K RAM expandable to 4K, 2K RAM, sophisticated monitor expandable 8K, 6-digit LED display plus a built-in speaker, cassette interface, and sockets to accept optional



CTC/PIO, BUS is extendable. As well as being an exciting learning tool, the MPF-I is a great lowcost board for OEM's.



**MULTITECH ELECTRONICS INC.**  
195 WEST EL CAMINO REAL SUNNYVALE, CA  
94087 U.S.A. TEL: 408-7738400  
TLX: 176004 MAC SUVL FAX: 408-7498032

\*Z-80 is a trademark of Zilog Inc.

### Distributor list U.S.A

#### Learning Labs, INC.

P.O. Box 122  
Calhoun, GA 30701  
TEL: 404-629-1521

#### SIVAD INC

P.O. Box 16664,  
Jackson, MS39206  
TEL: 601-355-3110

#### Technical Laboratory Systems, INC.

P.O. Box 218609  
Houston, TX77218  
TEL: 713-465-9793

#### L.A.B. Corporation

4416 River Road  
Afton, MN 55001  
TEL: 612-436-1169

#### Etronics

3928 148th N.E.  
Redmond WA 98052  
206-881-0857

#### DIGIAC CORP.

175 Engineers Road,  
Smithtown, N.Y. 11787  
TEL: (516) 273-8600

### Canada Future Electronics INC.

#### Montreal

237 Hymus Boulevard  
Pointe Claire, Quebec  
H9R 5C7  
TEL: (514) 694-7710

#### OTTAWA

Boxter Centre  
1050 Boxter Road,  
Ottawa, Ontario K2C  
3P2

#### TORONTO

4800 Dufferin Street  
Downsview, Ontario  
M3H 5S8

#### CALGARY

5809 Macleod Trail  
South Unit 109 Calgary,  
Alberta T2H 0J9

#### Vancouver

3070 Kingsway  
Vancouver, B.C. V5R 5J7

Outside of North America mail to:

#### Multitech Industrial Corporation

977 Min Shen E. Road,  
105 Taipei, Taiwan, R.O.C.  
Tel: 02-769-1225 Tlx: 19162 MULTIC  
23756 MULTIC



practical with hands-on experience building circuits, using what you've learned in the previous modules. It covers three separate categories: bipolar transistors, field effect transistors, and linear integrated circuits. The course is intended to be used with Heath's *ET-3300B* trainer (available for \$99.95 as a kit or \$179.95, assembled); that trainer is also used with the other courses in the series.

Each lesson consists of a circuit and the theory upon which it is based. The material is arranged so that progressive self-study is encouraged. That assures not only an orderly progression through the material, but also that everything you learn will be reinforced.

### What's covered

Looking at the course, the first segment explores one of the building blocks of solid state electronics, the bipolar transistor. By the time you are finished with the unit you will know all about that device, its applications, and how to correctly use it in a circuit.

Unit Two deals with the Field Effect Transistor (FET). You'll study both Junction Field Effect Transistors (JFET's) and Metal Oxide Semiconductor Field Effect Transistors (MOSFET's) and how they function. You'll also learn how FET's differ from a bipolar transistors and see how FET's can be used in a wide variety of applications.

Among the topics and circuits covered are various types of oscillators, phase splitters, function generators, and amplifiers. By the time you are done with the unit you will know how to use the circuits covered, and why they work the way they do.

Unit three deals with linear IC's. In it, you will learn about such devices as op-amps and timers. Among the topics covered are how the devices work, what factors influence their operation, and how they are used in circuits. The circuits discussed include highpass, lowpass, and bandpass active filters; voltage followers; oscillators, and function generators. Several frequently used linear devices are dealt with in detail, including the 555 timer IC.

As is true of other Heath educational products, each unit builds on the material presented in the earlier ones. And, like those earlier courses, there are exam modules to test what you have learned; those help to insure that the material covered will be retained. Those exams will also help you to pinpoint any areas that you are weak in, enabling you to go back and review the material.

### What's included

Naturally, the course comes complete with every component you will need to build the circuits. Those parts include all the necessary transistors, capacitors, op-amps, and integrated circuits. Other components that are provided include speakers, potentiometers, and crystals; Heath even supplies such things as the jumper wires. To get the full benefit of the course some type of test equipment, such as a voltmeter and oscilloscope, is needed; you will have to provide that equipment as it is not included.

The course arrives well packaged and ready to use. It includes not only the components, but a plastic box in which to hold them—a nice touch—and a high-quality binder for the lessons. The material in the lessons is well-written and clearly illustrated. You really do get your money's worth.

One word of caution: Despite the obvious care that Heath takes in packaging the materials some errors do happen so it is wise to check your course against the parts list. In the course we received for this review, an electrolytic capacitor, crucial to one experiment, was left out. However, Heath's parts department came through and we received the missing part in short order.

Overall, the Heath *EH-701* linear circuits course is a good hands-on learning experience. It should be valuable to anyone from the novice hobbyist just dabbling with circuits to the advanced technician who needs a refresher course. It is an excellent addition to Heath's educational line.

**R-E**

*continued on page 32*

# WE DELIVER FREE!



\* If order is 5 lbs. or less, good only shipped in the continental U.S. with a purchase of \$75 or more.



**FREE  
T-SHIRT!**

\* With Order of \$75 or More

## FREE CATALOG!

JUST CALL TOLL FREE TODAY!

**1-800-543-3568**  
NATIONAL WATS

**1-800-762-3412**  
OHIO WATS

705 WATERVLIT AVE.  
DAYTON, OH 45420

THESE ITEMS ARE FOR 10 OR MORE  
SORRY, NO MIXED QUANTITIES

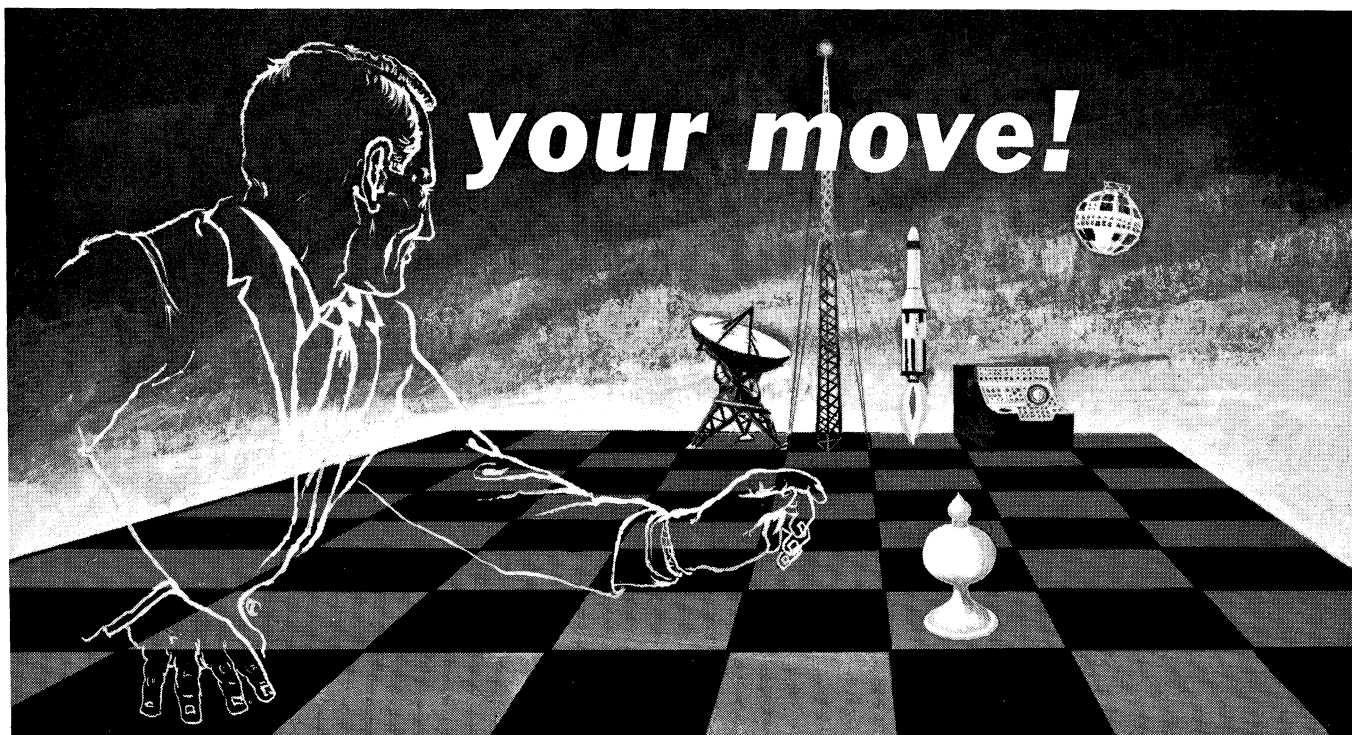


IN DAYTON, OHIO  
CALL 252-5662  
TELEX NO. 288-229  
\$10 MINIMUM ORDER.

**Consolidated Electronics Incorporated**



# Where's Your **ELECTRONICS** Career Headed?



## The Move You Make Today Can Shape Your Future

Yes it's your move. Whether on a chess board or in your career, you should plan each move carefully. In **electronics**, you can *move ahead* faster and further with a

## B. S. DEGREE

Put professional knowledge and a COLLEGE DEGREE in your electronics career. Earn your degree through independent study at home, with Grantham College of Engineering. No commuting to class. Study at your own pace, while continuing your present job.

The accredited Grantham non-traditional degree program is intended for mature, fully employed workers who want to upgrade their careers . . . and who can successfully study electronics and supporting subjects through

### INDEPENDENT STUDY, AT HOME

Free Details Available from:

**Grantham College of Engineering**  
2500 South La Cienega Blvd.  
P. O. Box 35499  
Los Angeles, CA 90035

### Independent Home Study Can Prepare You

Study materials, carefully written by the Grantham staff for independent study at home, are supplied by the College, and your technical questions related to those materials and the lesson tests are promptly answered by the Grantham teaching staff.

### Recognition and Quality Assurance

Grantham College of Engineering is accredited by the Accrediting Commission of the National Home Study Council.

We are located at 2500 S. LaCienega Blvd., Los Angeles, California, but for faster response please use our mailing address: P. O. Box 35499, Los Angeles, CA 90035.

**Grantham College of Engineering** 12-83  
P. O. Box 35499, Los Angeles, CA 90035

Please mail me your free catalog which explains your B.S. Degree independent-study program.

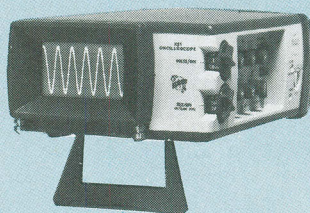
Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_



## Tektronix 221 Portable Oscilloscope



CIRCLE 104 ON FREE INFORMATION CARD

Tektronix										221
OVERALL PRICE										
EASE OF USE										
INSTRUCTION MANUAL										
PRICE / VALUE										
	1	2	3	4	5	6	7	8	9	10
	Poor			Fair			Good			Excellent

YOU MIGHT WONDER WHY ANYONE would want an oscilloscope with a display

that measures only about 2½ inches diagonally. But when you consider that the

## Electronics Paperback Books Projects For Project Builders

CHECK OFF THE BOOKS YOU WANT

**1st Book of Hi-Fi Loudspeaker Enclosures**.....\$4.50. Build your own speaker enclosures—corner reflex, bass reflex, folded horn, labyrinth and more.

**28 TESTED TRANSISTOR PROJECTS**.....\$4.25. A variety of projects for beginner and pro alike. Try this one. You'll like it.

**SOLID-STATE SHORT-WAVE RECEIVERS FOR BEGINNERS**.....\$4.50. Several receiver designs that use only relatively few and inexpensive components.

**50 PROJECTS USING THE CA3130**.....\$4.50. How to use this op-amp to make audio, rf, test equipment and household oriented projects.

**50 CMOS IC PROJECTS**.....\$4.50. Build multivibrators, amplifiers, oscillators, trigger devices and special devices.

**HOW TO BUILD ADVANCED SHORT-WAVE RECEIVERS**.....\$5.00. Quality receivers and accessories you can make yourself.

**BEGINNERS GUIDE TO BUILDING ELECTRONIC PROJECTS**.....\$5.00. Component identification, tools, soldering, construction techniques.

**Essential Theory for the Electronics Hobbyist**.....\$5.00. Provides the background knowledge needed by the hobbyist.

**52 PROJECTS USING THE 741**.....\$4.00. If you have some 741's on hand, this book will show you what you can do with them.

**HOW TO BUILD YOUR OWN METAL & TREASURE LOCATORS**.....\$5.00. Heterodyne metal locators described here might make you rich.

**50 CIRCUITS USING GERMANIUM, SILICON & ZENER DIODES**.....\$3.75. On the wonderful world of diodes. Lots of applications for inexpensive devices.

**50 PROJECTS USING RELAYS, SCRs & TRIACS**.....\$5.00. Motor control, dimming and heating control, light modulators, alarms, delayed timing and more.

**50 (FET) FIELD-EFFECT TRANSISTOR PROJECTS**.....\$4.50. RF amplifiers, rf converters, test equipment, aids, tuners, receivers, mixers, etc.

**50 SIMPLE LED CIRCUITS**.....\$4.25. Interesting and useful applications for LEDs. An important book for any project builder.

**HOW TO MAKE WALKIE-TALKIES**.....\$5.00. Everything from licensing to frequency bands to practical circuits to antennas.

**IC 555 PROJECTS**.....\$5.00. Basic & general circuits, motor car model, railroad car model, alarms, noisemakers, plus a section on the 555, 558, 559.

**PROJECTS IN OPTOELECTRONICS**.....\$5.00. Infra-red transmitters, detectors, modulated-light transmitters, photographic projects are just some examples.

**RADIO CIRCUITS USING IC'S**.....\$4.50. Integrated circuits and how they can be used in circuit for AM, FM and stereo decoder receivers.

**ELECTRONIC PROJECTS FOR BEGINNERS**.....\$5.00. A variety of projects, many with component wiring layouts. Some that require no soldering.

PRICES GOOD UNTIL MARCH 31, 1984

ELECTRONIC TECHNOLOGY TODAY INC.  
P.O. Box 240, Massapequa Park, NY 11762

12 83B

Number of books ordered ☐

Total Price of Books

Sales Tax (NY State Residents only)

Shipping and Handling

(75¢ 1 or 2 books 30¢ each addl. book)

TOTAL ENCLOSED

Name

Address

City

State

Zip

same scope weighs only 3½ pounds and measures 3 × 9 × 5¼ inches, the small display seems to be a limitation you might be willing to put up with.

The scope that fits those dimensions is the 221 from Tektronix (Box 500, Beaverton, OR 97077). The 221 is a portable, single-channel scope with a vertical bandwidth of five megahertz.

Although the 221 is a portable instrument, it can be run off line voltage as well as its 10 internal type "A" nickel-cadmium batteries. With a full charge, those batteries will power the scope for two to three hours (depending on the trace intensity used). A BATTERY meter on the side of the instrument indicates FULL, LOW, and RECHARGE. When the meter reads LOW, there is less than 10 minutes of operating time left. When it reads RECHARGE, it indicates that the battery charge has dropped to less than 10 volts and a battery discharge protection circuit has automatically interrupted the scope's operation to prevent excessive discharge.

Whenever the line cord is plugged in to the line voltage (greater than 90 volts), the batteries will be charged whether the scope is on or off. When the line cord is removed, however, we have a problem—a potential shock hazard. If you make voltage measurements with the common lead floated, it is possible—due to RFI circuitry connected between the AC power plug and the 221's common—that small amounts of current from the elevated reference will be present on the AC power plug.

The manuals clearly point that out (several times) and a caution is written on the oscilloscope over a storage compartment for the AC plug. (That's where they strongly recommend that you store the plug when you use the scope as a portable instrument.) We feel, though, that any test instrument should be fool-proof—safe even for those who refuse to read or follow safety warnings.

### Controls and features

The controls are laid out on the right side of the instrument, about as neatly as you could hope for in such a small unit. The VOLTS/DIV and SEC/DIV controls are located on the right panel at the front of the 221 and can be read when looking straight on at the scope. All other controls are located in a recess on the side panel. Six rotary controls include vertical and horizontal position controls, controls to continuously vary the volts/div and sec/div deflection factors, a trace-intensity control that includes the power switch, and a LEVEL/SLOPE control that selects both the amplitude and slope of the signal that will trigger the sweep. That control can be set to AUTO PRESET.

There are also three slide switches: the INPUT COUPLING switch chooses between AC or DC coupling and ground. The HORIZ-MAG switch can be used to increase the sweep time (or the horizontal sen-



sitivity in the X-Y mode) by a factor of ten. The last switch chooses between an internal and external trigger.

There are six screwdriver-adjustable controls on the side panel. The STEP ATTEN BAL adjustment balances the vertical system so that the trace will not shift as you change deflection factors. There are also trace FOCUS and TRACE ROTATION as well as adjustments to calibrate the vertical gain and horizontal sweep. The final side-panel adjustment selects the preset trigger point for AUTO sweep operation.

As you can see, those controls don't differ too much from a standard (larger) scope. How about the input jacks? There are banana-plug jacks for COMMON and EXT TRIG (OR HORIZ INPUT for the X-Y mode). There is no jack for the vertical channel—the probe is permanently connected to the scope and can be neatly stored when not in use.

### Specifications

Now that we have a good idea of the general features of the 221, let's look at it a bit closer. We'll start with the graticule, which is an internal, non-illuminated, 6-by 10-division grid. Because of its size, it's not something we would want to work with on a test bench, but we'd be willing to put up with it in the field. A non-illuminated graticule is an advantage because it helps reduce battery drain.

We'll move on to the vertical amplifier, which has a 1-megohm input impedance and a 30-pF input capacitance. The vertical deflection factor is controlled by the VOLTS/DIV that is arranged in a 1-2-5 sequence (from 5 millivolts to 100 volts-per-division). When the VAR is in its detent (CAL) position, the 221 is accurate to within 3 percent. When that control is moved off its detent position, it can continuously increase the vertical deflection factor by at least 3:1 on every scale. The maximum safe input voltage is 600 volts peak-to-peak AC or 600 volts DC + peak AC.

The horizontal deflection system can be used with the internal sweep generator or an external voltage input. The sweep generator's SEC/DIV control is arranged in a 1-2-5 sequence from 200 milliseconds to one microsecond-per-division. The VAR can be used to continuously decrease the sweep rate by a factor of about 2.5. Also, the HORIZ-MAG can be used to increase the sweep rate by a factor of ten.

When the horizontal deflection system is used to measure an external voltage, you have a choice of two deflection factors: 1 volt-per-division or 0.1 volts-per-division (when the HORIZ-MAG switch is in its 10x position). The bandwidth of the horizontal amplifier is 500 kHz, its input resistance is 500 kilohms, and its input capacitance is 30 pF. The same jack that is used for an external trigger input is used for a horizontal voltage input.

Aside from its battery operation, one feature of the 221 that makes it very portable is that it will operate over a large line-

voltage range. Its AC range is from 90 to 250 volts (48 to 62 Hz). Its DC range is from 80 to 250 volts.

Now that we've discussed the scope, we can talk about the documentation that comes with it. Two manuals were supplied with our unit: a service instruction manual and an operator's instruction manual. The operator's manual is a small spiral-bound book that gives a quick overview of the 221, its controls, and some basic test setups and procedures. The service manual is a much larger book. As we have come to expect from Tektronix, it is loaded with information including an overview of the scope, information on preventive and corrective maintenance, a

detailed circuit description, calibration procedures, troubleshooting aids, complete electrical- and mechanical-parts lists, and complete schematics and parts-placement illustrations.

All in all, we liked the 221. As with most of what we see, there are some things we'd like to change. For example, we'd like to see a front-panel power indicator to reduce the chance of leaving the scope's power on, and we'd like to see the tilt-bail double as a carrying handle. But we have no complaints about how the 221 operates. If you need a lightweight, small-sized, battery-operated scope, and the \$1775 price doesn't scare you off, then the 221 might be just for you. **R-E**

## Scan the World.



### R-2000

**SSB, CW, AM, FM, digital VFO's, 10 memories, memory/ band scan, optional 118 – 174 MHz coverage...**

**The R-2000 is an innovative all-mode SSB, CW, AM, FM receiver that covers 150 kHz – 30 MHz, with an optional VC-10 VHF converter unit to provide coverage of the 118-174 MHz frequency range.**

#### R-2000 FEATURES:

- Covers 150 kHz – 30 MHz in 30 bands. UP/DOWN band switches. VFO's tune across 150 kHz – 30 MHz.
- All mode: USB, LSB, CW, AM, FM.
- Digital VFO's. 50-Hz, 500-Hz or 5-kHz steps.
- F. LOCK switch.
- Ten memories store frequency, band, and mode data. Each memory may be tuned as a VFO. Original memory frequency may be recalled.
- Lithium batt. memory back-up. (Est. 5 yr. life).
- Memory scan. Scans all or selected memories.
- Programmable band scan. Scans within programmed bandwidth.
- Fluorescent tube digital display of frequency (100 Hz resolution) or time. DIM switch.
- Dual 24-hour quartz clocks, with timer.
- Three built-in IF filters with NARROW/WIDE selector switch. (CW filter optional.)
- Squelch circuit, all mode, built-in.
- Noise blanker built-in.
- Tone control.
- Large front mounted speaker.
- RF step attenuator. (0-10-20-30 dB.)
- AGC switch. (Slow-Fast.)
- "S" meter, with SINPO "S" scale.
- High and low impedance antenna terminals.
- 100/120/220/240 VAC, or 13.8 VDC (Option) operation.
- RECORD output jack
- Timer REMOTE output (not for AC power)
- "Beeper"
- Carrying handle.



**R-1000** High performance receiver • 200 kHz – 30 MHz • digital display/clock/timer • 3 IF filters • PLL UP conversion • noise blanker • RF step attenuator • 120-240 VAC (Optional 13.8 VDC).



**R-600** General coverage receiver • 150 kHz – 30 MHz • digital display • 2 IF filters • PLL UP conversion • noise blanker • RF attenuator • front speaker • 100-240 VAC (Optional 13.8 VDC).

#### Optional accessories:

- VC-10 118-174 MHz converter.
- HS-4, HS-5, HS-6, HS-7 headphones.
- DCK-1 DC cable kit.
- YG-455C 500-Hz CW filter.
- HC-10 World digital quartz clock.
- AL-2 Surge Shunt

## KENWOOD

**TRIO-KENWOOD COMMUNICATIONS**  
1111 West Walnut/Compton, CA 90220  
Telephone: (213) 639-9000



# NTS Electronics

**Learn Robotics, Microcomputers, Microprocessors, Digital Video, Test Equipment and more with NTS INTRONIC™ home training. Courses include state-of-the-art equipment, lessons and texts to make your hands-on programs exciting and down-to-earth practical.**

**HERO 1** is included in two courses, one basic and one advanced. You'll cover principles of industrial electronics, microprocessor troubleshooting, fundamentals of mechanics, and robotic applications in industry. You'll learn analog and digital skills, radio control, fluidic, pneumatic and servo-mechanisms, as well as computer interfacing and robotic programming. **HERO 1**, complete with arm, gripper and speech synthesis board, is a fully self-contained electro-mechanical robot—the featured unit in the most exciting training programs ever offered in home study.

**NTS Intronic Training** is a carefully developed and tested learning system providing a thorough intergration of advanced electronic hardware with modern lesson texts. The relationship between theory and practical applications is made clear through the hands-on experience of building and assembling kits of state-of-the-art equipment. Courses include a wide variety of test instruments, both digital and analog, as well as other units not shown here. And, depending on the NTS program you select, you can earn up to 30 CEU credits for successful completion. Our full-color catalog has complete details. NTS has taught industrial skills for over 78 years—a record that has no equal.





# Training.....

## FIRST WITH TOMORROW'S TECHNOLOGY

1. **Advanced "Z Chassis" NTS/HEATH "Smart Set"** with computer space command remote control and space phone. Originate or receive telephone calls through this set and the number appears on the screen-store your police and other emergency numbers into memory which may be recalled and auto-dialed at any time. Traditional and incomparable picture quality. Unit has Quartz Controlled Tuning, 178 channel capacity, remote antenna switch accessory for reception of VCR, VDR, Broadcast, Cable, Video Games, and Personal Computer Input (no cable change) plus computer-controlled color. Featured in all-new Video Technology Course.

2. **NTS/HEATH HN89A Microcomputer** is included in two programs. This famous and reliable unit features Floppy Disc Drive, 48K Memory on Board, CRT Terminal with its own Z-80 Processor, and standard keyboard as well as Numerical Input Keyboard. The growing importance of computer knowledge and skills have made these programs increasingly significant. The experience gained in assembling these kits is invaluable in the understanding of computer troubleshooting skills.

3. **NTS Microprocessor Trainer** is included in our Industrial and Microprocessor Technology Course. It is a portable unit, contained in a convenient high-impact carrying case. Hardware/Firmware includes Monitor Operating System-Expandable User Memory-User Experimental On-Board Section-Breakpoint Editor-Single Step Trace-Cassette I/O.



NO OBLIGATION

NO SALESMAN WILL CALL



**NATIONAL  
TECHNICAL  
SCHOOLS**

TECHNICAL TRADE TRAINING SINCE 1905  
Resident and Home-Study Schools

4000 So. Figueroa St., Los Angeles, CA 90037

Use the mail-in card or fill out and mail the coupon. Indicate the field of your choice. (One, only please.) FREE full color catalog will be sent to you by return mail.

**NATIONAL TECHNICAL SCHOOLS** Dept. 206-123  
4000 South Figueroa Street, Los Angeles, CA 90037

Please send FREE color catalog on course checked below:

- |   |   |
|---|---|
| <input type="checkbox"/> Robotics                       | <input type="checkbox"/> Computer Electronics |
| <input type="checkbox"/> Digital Electronics            | <input type="checkbox"/> Video Technology     |
| <input type="checkbox"/> Auto Mechanics                 | <input type="checkbox"/> Home Appliances      |
| <input type="checkbox"/> Air Conditioning/Solar Heating |   |

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

Apt. \_\_\_\_\_ City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

☐ Check if interested in G.I. information.

☐ Check if interested ONLY in classroom training in Los Angeles



# NEW IDEAS

## Sound-activated AC switch

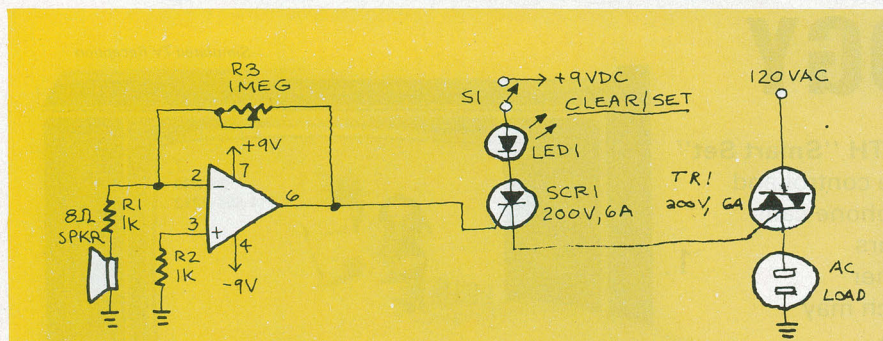


FIG. 1

WHILE LOOKING THROUGH SEVERAL REFERENCE books and periodicals for various switching methods, I not only found very little concerning sound-activated switches in general, but there was almost a complete absence of sound-activated switches that would directly switch an AC load. Switching on such a load is a fairly easy problem that could be handled by a (mechanical) relay system. But I've found that it's just as easy to put together an inexpensive, reliable, non-mechanical sound-activated AC switch.

The circuit, shown in Fig. 1, uses a 741 op-amp operating as an inverting amplifier. It amplifies the voltage produced by an 8-ohm speaker. That speaker is used here to detect any sounds. The feedback resistor, R3, a 1-megohm potentiometer can be used to vary the gain of the amplifier—it determines the sensitivity of the circuit.

When S1 is closed in the (SET position) and a sound is applied to the speaker, the silicon-controlled rectifier (SCR1) is turn-

ed on. It will remain in conduction until the anode voltage is removed by opening S1—putting it in its RESET position. (Once an SCR is turned on, the gate or trigger has no control over the circuit.) As long as the SCR conducts, the Triac, TR1, will remain on and supply voltage to the load.

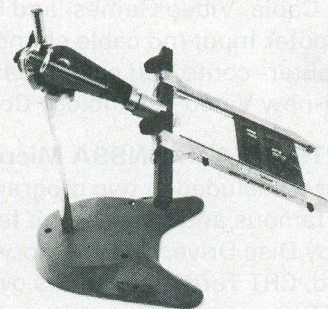
The ratings of the components shown in the schematic should be sufficient for most household uses, but you can change them if you want to control a larger load. The unit should be mounted in a case for safety, and a standard AC socket should be mounted in the front panel.

The circuit in Fig. 1 is fairly simple and it can be adapted for any number of uses. You can try a lowpass or highpass filter system at the input of the op-amp so that the switch will respond only to certain frequencies—a whistle, perhaps. The best thing about this circuit is that it can help you to understand better how to use the Triac and SCR in control applications.—Jeffery N. Krumm

### NEW IDEAS

This column is devoted to new ideas, circuits, device applications, construction techniques, helpful hints, etc.

All published entries, upon publication, will earn \$25. In addition, Panavise will donate their model 333—The Rapid Assembly Circuit Board Holder, having a retail price of \$39.95. It features an eight-position rotating adjustment, indexing at 45-degree increments, and six positive lock positions in the vertical plane, giving you a full ten-inch height adjustment for comfortable working.



I agree to the above terms, and grant **Radio-Electronics** Magazine the right to publish my idea and to subsequently republish my idea in collections or compilations of reprints of similar articles. I declare that the attached idea is my own original material and that its publication does not violate any other copyright. I also declare that this material has not been previously published.

Title of Idea

Signature

Print Name

Date

Street

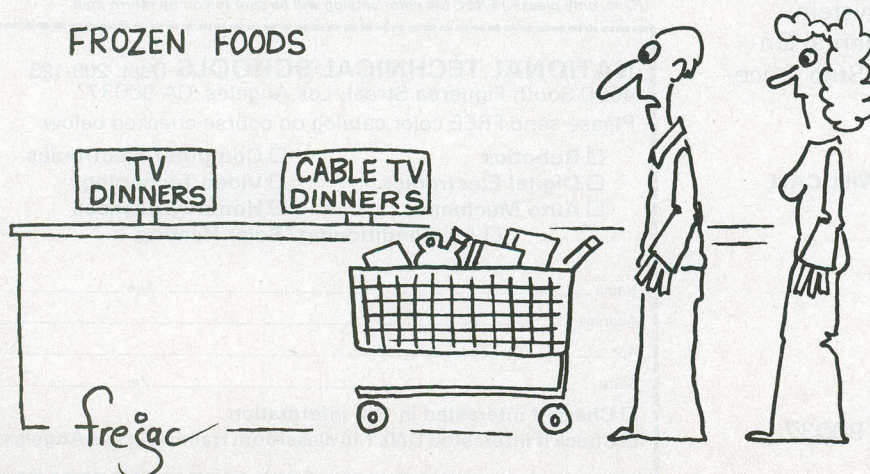
City

State

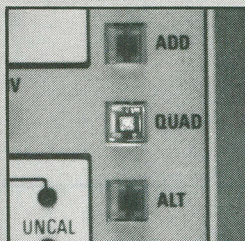
Zip

Mail your idea along with this coupon to: **New Ideas Radio-Electronics**, 200 Park Ave. South, New York, NY 10003

### FROZEN FOODS

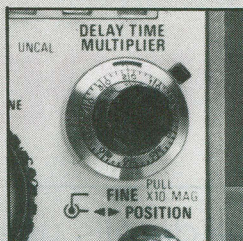




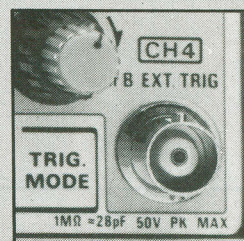


SOFT TOUCH  
FULL-LOGIC  
CONTROLS

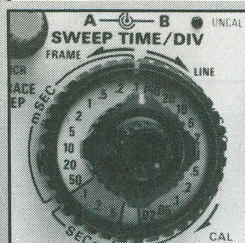
DUAL INDEPENDENT  
TIME BASE (1590 ONLY)



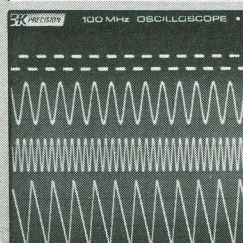
CALIBRATED  
DELAYED SWEEP



4 VERTICAL  
INPUT CHANNELS



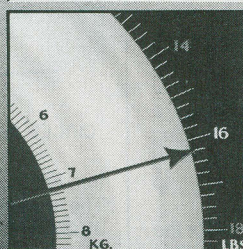
DUAL TIME BASE



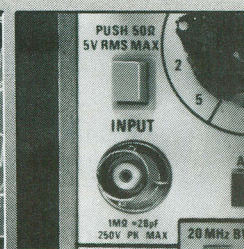
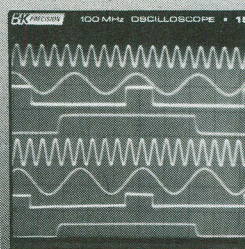
EXCLUSIVE  
V MODE

8-TRACE DISPLAY

SWITCHABLE  
INPUT IMPEDANCE (1590 ONLY)

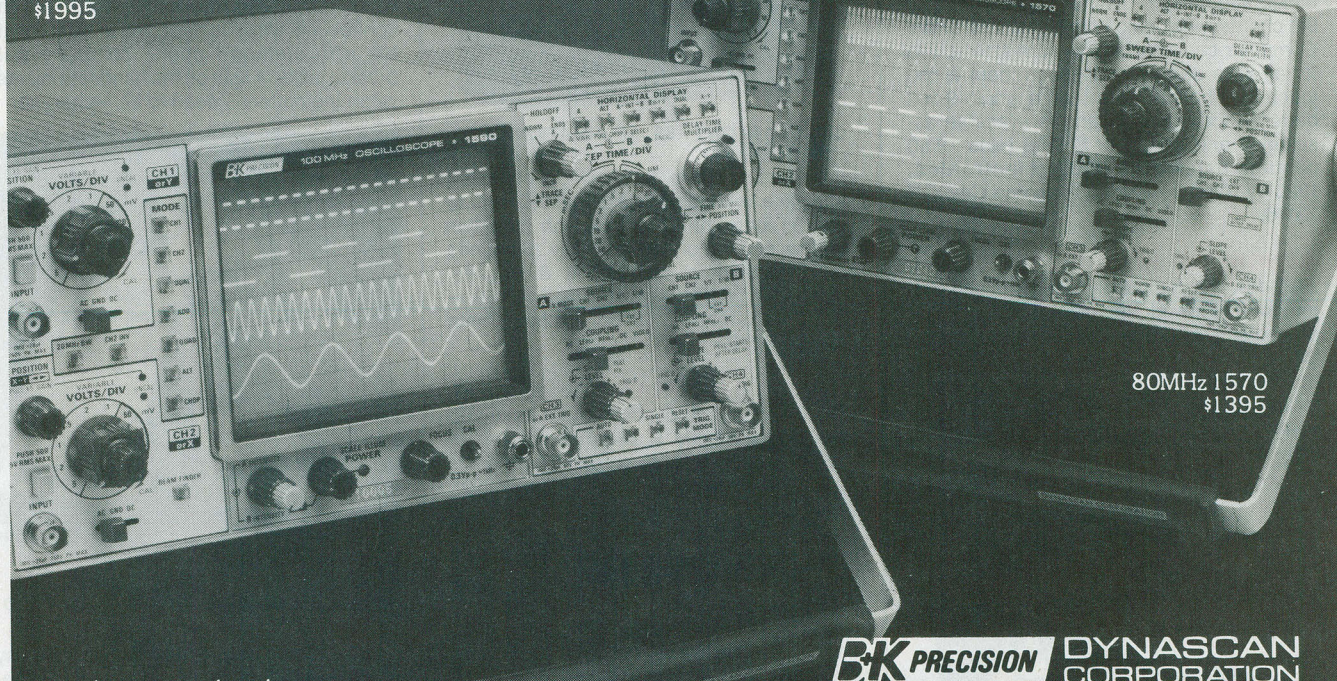


LIGHT WEIGHT  
16.25 LBS.



# Looking for an 80 or 100MHz scope? B&K-PRECISION just eliminated the competition.

100MHz 1590  
\$1995



80MHz 1570  
\$1395

To learn more about how  
B&K-PRECISION has eliminated the competition,  
see your local distributor  
Available for immediate delivery

**B&K PRECISION** DYNASCAN CORPORATION

6460 West Cortland Street • Chicago, Illinois 60635 • 312/889-9087  
Int'l. Sls., 6460 W. Cortland St., Chicago, IL 60635  
• Canadian Sales, Atlas Electronics, Ontario  
South and Central American Sales, Empire Exporters, Plainview, NY 11803

CIRCLE 77 ON FREE INFORMATION CARD

DECEMBER 1983

39



# NEW PRODUCTS

For more details use the free information card inside the back cover

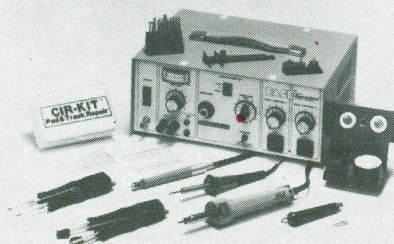
**CHORD COMPUTER**, is palm-sized, and will help musicians to understand both music and keyboards. Selecting a chord letter instructs the *Chord Computer's* 31-key piano-key-



CIRCLE 111 ON FREE INFORMATION CARD

board LCD to display which notes are to be played for the selected chord. Pressing another button allows for sharp, flat, major, minor, augmented, diminished, 6th, 7th, or 9th chords—including inversions. The *Chord Computer* can also display complete scales for all keys and can transpose them at the touch of a button. It runs off a single 9-volt battery (not included) and is available assembled and tested for \$59.95 (plus \$2.50 postage/handling).—**PAIA Electronics**, 1020 W. Wilshire Blvd., Oklahoma City, OK 73116.

**BENCH-TOP REPAIR SYSTEM**, the *PRC-151*, is a completely self-contained system for any rework, repair, or modification of printed-circuit boards. It can perform the following repair operations: temperature-controlled desoldering (removal of components); milling, drilling, and grinding for general PC-board repair; removal of conformal coatings, high-strength reflow soldering; thermal wire



CIRCLE 112 ON FREE INFORMATION CARD

stripping, and resistance heating capacity.

The *PRC-151* incorporates zero-power switching so that the complete system is safe for working on sensitive boards and components. It comes complete with a new power source featuring *Thermo-Drive* heat control, a "no clog" dual-path solder extractor, a precision miniature machining unit with deluxe tool set, a pad and track selector pack, a deluxe soldering iron, resistance tweezer, thermal wire stripper, probe for conformal coatings, a soldering-iron stand with wet and dry cleaning facilities, and a lead measuring and forming tool, cleaning brushes and experimental tip kit, and a universal power cord.

The manufacturer's suggested price for the *PRC-151* is \$1175.00. Systems are available from all authorized Pace distributors. For information on your local Pace distributor, contact Pace, Incorporated (301) 490-9860.—**Pace Incorporated**, 9893 Brewers Court, Laurel, MD 20707.

**AMPLIFIER**, model *DDX410*, is a MOSFET stereo amplifier, producing 205 watts per channel continuous power, at its rated distortion, at any impedance from 2 ohms up to 8 ohms and in excess of 500 watts at 8 ohms in



CIRCLE 113 ON FREE INFORMATION CARD

bridged mono mode. Full power is produced at any line voltage from less than 95 volts to over 135 volts. The slew rate is high, distortion rate low, and the unit weighs only 16 pounds with dimensions of 5 × 13½ × 8½ inches. The model *DDX410* is priced at \$449.00.—**Soundcraftsman**, 2200 So. Ritchey, Santa Ana, CA 92705.

**COMPACT DISC PLAYER**, model *XL-V1*, features soft-touch controls and a multi-purpose digital display. It also incorporates an error-correction code to correct for dropouts or reading errors by means of interpolation. The frequency response is 5 Hz to 20 kHz, and it can play up to 75 minutes per compact disc. Random-track selection allows users to program up to 15 tracks for play in any order selected. A CLEAR button makes it easy to change or cancel programmed tracks, while a CALL button lets the user confirm the entered selections.

Other operations include pause, memory stop, analog location indicator (an LED display of approximate time elapsed since play began), headphone output with volume con-



CIRCLE 114 ON FREE INFORMATION CARD

trol, and both fixed and variable line outputs. The model *XL-V1* is priced at \$1000.00.—**JVC Company of America**, 41 Slater Drive, Elmwood Park, NJ 07407.

**CORDLESS TELEPHONE**, the *Freedom Phone 350*, can be used up to 500 feet from its control unit, and there is no external handset antenna to get in the way. It can dial up to 10 phone numbers automatically from its memory: By pushing just two buttons, any important number—emergency, office, doctor, or dentist, etc., can be dialed. The numbers can easily be changed by reprogramming the handset's touch-button pad.

The *Freedom Phone 350* is designed so that it can be either a wall or a table phone; when not in use, the handset fits into the control unit, which is designed to be compatible with standard phone company wall/bracket jacks. A light on the handset indicates when the batteries need to be recharged.



CIRCLE 115 ON FREE INFORMATION CARD

Also featured is automatic redialing of busy or unanswered numbers, and there is a special two-position volume control that allows the user to select louder than normal volume, as well as a "mute position" to disconnect the

*continued on page 44*



# Radio-Electronics Software Store

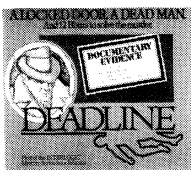
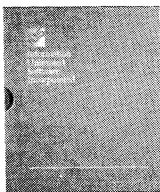
New for our readers....A mailorder source of software for Atari 400, Atari 800, IBM P C, Commodore VIC-20, Apple II, and other personal computer systems.

## IBM PC



☐ **FLIGHT SIMULATOR** by Microsoft ... List \$49.95. Our price ... \$43.00. Highly accurate simulation of flight in a single-engine aircraft. Working instruments. Out the window graphics. Real-time flight conditions. (IBM P C, 64k, color graphics, disc)

☐ **EASYWRITER II** by Information Unlimited ... List \$350.00. Our price ... \$300.00. Turns your computer into a word processor. You see everything on the screen. There are no imbedded commands. (IBM P C, disc)



☐ **DEADLINE** by Infocom ... List \$49.95. Our price ... \$43.00. A locked door. A dead man. You have 12 hours to solve the mystery. One false move, and the killer strikes again. (IBM P C, 48k, disc)

☐ **ALGEBRA, Vol. 1** by Eduware ... List \$39.95. Our price ... \$34.00. A first year algebra tutorial covering definitions, number line operations, sets, etc. (IBM P C, 48k, color graphics, disc)



☐ **MICRO/TERMINAL** by Microcom ... List \$94.95. Our price ... \$83.00. Allows access to remote mainframes and minis, information data banks, and other personal computers. (IBM P C, disc)

☐ **PC TUTOR** by Comprehensive Software ... List \$79.95. Our price ... \$69.00. Interactive program teaches you how to use your IBM Personal Computer, including hardware and software. (IBM P C, 64k, disc)



## APPLE



☐ **PRISONER2** by Interactive Fantasies ... List \$32.95. Our price ... \$28.00. Escape is hardly possible. The island keeps you under surveillance. Just try and get out! (Apple II, 48k, disc)

☐ **PRISONER2** by Interactive Fantasies ... List \$39.95. Our price ... \$34.00. (Atari disc)

☐ **THE MASK OF THE SUN** by Ultrasoft Inc ... List \$39.95. Our price ... \$34.00. An animated adventure through a series of hi-res screens. An ultimate adventure challenge. (Apple II, 48k, disc)



☐ **MASTERTYPE** by Lighting Software ... List \$39.95. Our price ... \$34.00. A typing instruction system in an exciting hi-res game format. Learn to type while battling waves of attacking enemy words. (Apple II, 48k/64k, disc)

☐ **THE GRAPHICS MAGICIAN** by Penguin Software ... List \$59.95. Our price ... \$53.00. Make your own animated graphics. Handles up to 32 independent objects. Stores hundreds of color pictures. (Apple II, 48k, disc)



☐ **RENDEZVOUS** by Eduware ... List \$39.95. Our price ... \$34.00. In four phases, simulates an actual space-shuttle flight from Earth Liftoff through Orbital Rendezvous and Approach to Alignment Docking with a space station. Hi-res graphics (Apple II, disc)

☐ **SAT WORD ATTACK SKILLS** by Eduware ... List \$49.00. Our price ... \$43.00. A tutorial for mastering vocabulary, deciphering new or unfamiliar words, and taking tests. (Apple II, disc)



## COMMODORE VIC-20



☐ **PIPES** by Creative Software ... List \$39.95. Our price ... \$34.00. Connect a pipeline from the water supply tank to every house. Watch out for leaks. Use as little pipe as possible. 5 skill levels. (Commodore VIC-20 cartridge)

☐ **SHAMUS** by Human Engineered Software ... List \$39.94. Our price ... \$34.00. Only you can stop the Shadow's mad reign of terror. Two levels with 20 rooms each. A joystick challenge. (Commodore VIC-20 cartridge)



☐ **HOUSEHOLD FINANCE** by Creative Software ... List \$17.95. Our price ... \$15.00. Home utility program records and analyzes your monthly income, expenses and budget in 16 categories. (Commodore VIC-20 tape cassette)

☐ **HOME OFFICE** by Creative Software ... List \$29.95. Our price ... \$25.00. Combines VICPRO, a flexible and efficient word processor with VICDATA a powerful and sophisticated information storage and retrieval system. (Commodore VIC-20, cassette tape, 8k additional memory required)



## ATARI



☐ **SUBMARINE COMMANDER** by Thorn EMI ... List \$49.95. Our price ... \$43.00. A submarine patrol simulator to hunt and destroy enemy ships. 9 skill levels. Plug-in cartridge. (Atari Cartridge 400/800)

## APPLE

☐ **MINER 2049** by MicroLab ... List \$39.95. Our price ... \$34.00. Chase into a Uranium mine thru 10 levels of traps and capture Yukon Yohan. Scale ladders, jump from moving platforms, and win—if you can. (Apple II, 48k, disc)



## Radio-Electronics Software Store

200 Park Avenue South  
New York, NY 10003

Number of items ordered ☐

Total Price of Software .....\$

Sales Tax (NY State Residents Must Include) .....

Shipping (\$2.00 per item) .....

TOTAL ENCLOSED (Sorry, No COD's) .....\$

Name .....

Address .....

City ..... State ..... ZIP .....

SORRY - NO CREDIT CARD OR COD ORDERS



HITACHI

NLS Non-Linear Systems

HICKOK

WESTON

DATA PRECISION

KEITHLEY

AWS  
A.W. SPERRY  
INSTRUMENTS INC.

FLUKE

PHILIPS

BK PRECISION

VIZ R&amp;A

TRIPLETT

Simpson

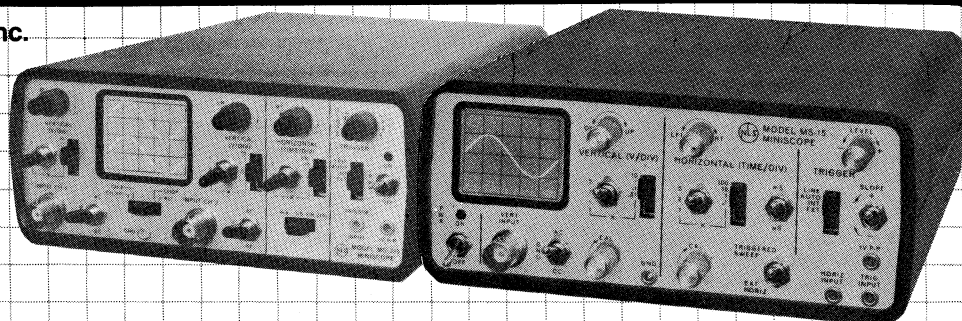
LEADER



Non-Linear Systems, Inc.

## OSCILLOSCOPES

MS15 15 MHz Single Trace  
MS215 15 MHz Dual Trace  
MS230 30 MHz Dual Trace

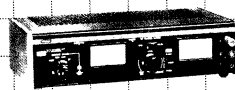


Non-Linear Systems' trio of miniscopes are accurate, affordable, portable. And there's one to match nearly every budget and need. Standard features on all models include an input impedance of 1 megohm with 50 pF; maximum input voltage of 350 V; trigger modes in auto, internal, external and line; slope that's + or - selectable; graticule (4 x 5 division of 0.25" each); dual power sources operating either internally from rechargeable lead acid batteries or externally from 115 VAC or 230 VAC (50-60 Hz) via plug-in transformer; handy size (2.9"H x 6.4"W x 8.0"D) and weighs just 3 lbs.\*

\*(Exception: model MS-230 is slightly deeper, at 8.6", and heavier, at 3.6 lbs.).

BK PRECISION

## POWER SUPPLIES



MODEL 1601

\$299<sup>95</sup>  
WAS \$359.



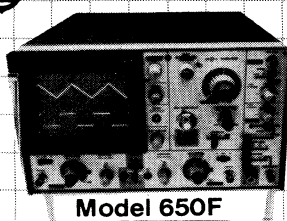
MODEL 1650

\$319<sup>95</sup>  
WAS \$390.

- Isolated 0-50VDC, continuously variable; 0-2A in four ranges
- Fully automatic shutdown, adjustable current limit
- Perfect for solid state servicing

- Functions as three separate supplies
- Exclusive tracking circuit
- Fixed output 5VDC, 5A
- Two 0 to 25VDC outputs at 0.5A
- Fully automatic, current-limited overload protection

HITACHI

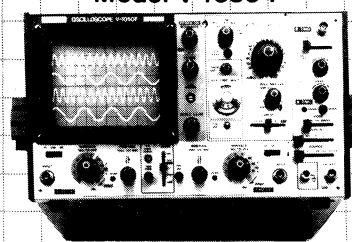


Model 650F

60 MHz DUAL TRACE  
DELAYED SWEEP

\$939<sup>95</sup>

Model V-1050-F



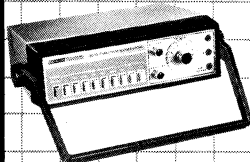
100 MHz QUAD TRACE  
DELAYED SWEEP

\$1499<sup>95</sup>

PRICE DOES NOT INCLUDE PROBES

BK PRECISION

## FUNCTION GENERATORS



MODEL 3010 \$179<sup>95</sup>  
WAS \$229.

MODEL 3020 \$319<sup>95</sup>  
WAS \$394.

MODEL 3010

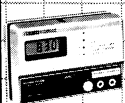
- Sine, square and triangle output
- Variable and fixed TTL outputs
- 0.1 Hz to 1MHz in six ranges
- Push button range and function selection
- Typical sine wave distortion under 0.5% from 1 Hz to 100kHz

SWEEP FUNCTION  
MODEL 3020

- Four instruments in one package—sweep generator, function generator, pulse generator, tone-burst generator
- Covers 0.02Hz-2MHz
- 1000:1 tuning range
- Low-distortion, high-accuracy outputs

BK PRECISION

## CAPACITANCE METERS



MODEL 830

\$189<sup>95</sup>  
WAS \$238.

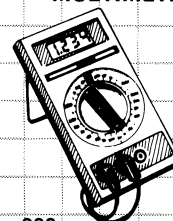
- Automatically measures capacitance from 0.1pF to 200mF
- 0.1pF resolution
- 0.2% basic accuracy
- 3½ digit LCD display



\$159<sup>95</sup>  
WAS \$192.

MODEL 820

- Resolves to 0.1pF
- 4 digit easy-to-read LED display
- Fuse protected against charged capacitors
- Overrange indication

BECKMAN  
DIGITAL  
MULTIMETERS

300 310 320  
330 350 360

ALL IN STOCK  
CALL FOR PRICES

ORDERING  
INFORMATION

We don't just take orders, we ship them  
*Advance Electronics*  
endeavors to keep everything  
we advertise in stock for  
immediate delivery.



- Mastercharge & Visa shipped within 24 hours.
  - Bank checks or Money Orders shipped within 24 hours.
  - Personal checks — please allow 3 weeks for check to clear.
  - All prices plus shipping charges. Please call for appropriate charges. Use our toll free number.
  - New York State residents add appropriate sales tax.
  - PRICES SUBJECT TO CHANGE WITHOUT NOTICE.
- Quantities are limited



HITACHI

NLS Non-Linear Systems

HICKOK

WESTON

DATA PRECISION

KEITHLEY

AWS  
A.W. SPERRY  
INSTRUMENTS INC.

FLUKE

PHILIPS

BK PRECISION

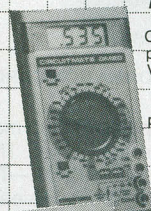
VIZ R&A

TRIPLETT

Simpson

LEADER

# BECKMAN'S CIRCUITMATE® AVAILABLE NOW . . . ALL UNDER \$100.



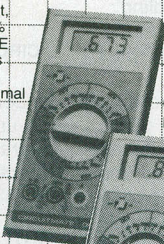
Circuitmate DM 20—3½-digit, pocket-size multimeter; 0.8% Vdc accuracy, diode test, hFE test, conductance, 10 amps AC and DC ranges, auto-polarity, auto-zero, auto-decimal

**\$64<sup>95</sup>**



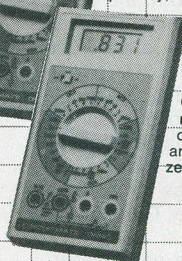
Circuitmate DM 25—3½-digit, pocket-size multimeter; 0.5% Vdc accuracy, diode test, capacitance, continuity beeper, conductance, 10 amps AC and DC ranges, auto-polarity, auto-zero, auto-decimal

**\$79<sup>95</sup>**



Circuitmate DM 40—3½-digit multimeter; 0.8% Vdc accuracy, diode test, auto-polarity, auto-zero, auto-decimal

**\$69<sup>95</sup>**



Circuitmate DM 45—3½-digit multimeter; 0.5% Vdc accuracy, diode test, continuity beeper, 10 amps AC and DC ranges, auto-zero, auto-polarity, auto-decimal

**\$89<sup>95</sup>**

**NEW**

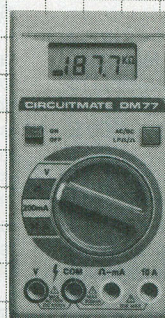


The DM73 is the smallest digital multimeter on the market. Its probe-style design makes it ideal for taking measurements in hard-to-reach test areas.

- Small Size
- "Touch Hold"
- Complete Autoranging
- Audible continuity checking

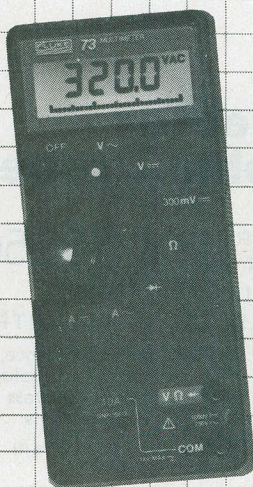
**\$72<sup>95</sup>**

**NEW**



The DM77 gives you the convenience of autoranging plus 10 amps ac/dc measurement capability. You simply select the function you want, and the DM77 automatically sets the required range.

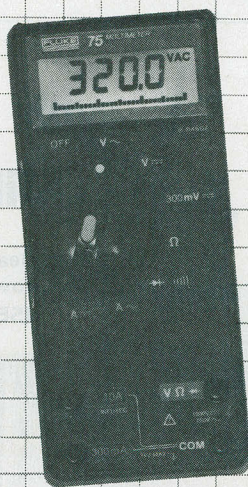
**\$76<sup>95</sup>**



73

**\$85<sup>00</sup>**

- 0.7% Accuracy
- Autorange Only
- 10 Amp Only



75

**\$99<sup>00</sup>**

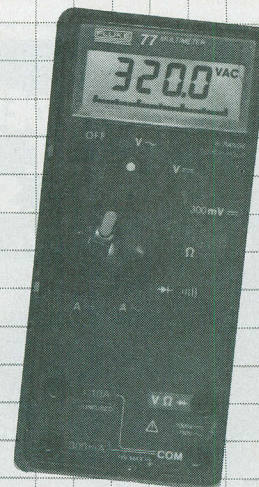
- 0.5% Accuracy
- Manual or Autorange
- 10A + 300 mA Range
- Beeper

FLUKE  
SERIES  
MULTIMETERS

- Analog Display • Rotary Knob
- Volts AC & DC • Resistance to 32 MΩ • 10 Amps • Diode Test
- 3200 Counts • Fast Autoranging
- Function Annunciators in Display
- Power-Up Self Test • 2000 + Hour Battery Life w/ Power Down "Sleep Mode" • New Test Leads • VDE & UL Approval

**NEW  
AVAILABLE NOW!**

**\$129<sup>00</sup>**



77

- 0.3% Accuracy
- Manual or Autorange
- 10 A + 300 mA Range
- Beeper
- "Touch-Hold" Function



TOLL FREE HOT LINE  
**800-223-0474**

THE TEST EQUIPMENT SPECIALISTS

26 WEST 46th STREET, NEW YORK, N.Y. 10036 212-730-7030

**ADVANCE  
ELECTRONICS**



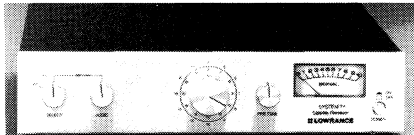
## NEW PRODUCTS

continued from page 40

microphone when conversing with another person in the room.

The *Freedom Phone 350* is priced at \$159.95.—**Electra Company**, 300 East County Line Road, Cumberland, IN 46229.

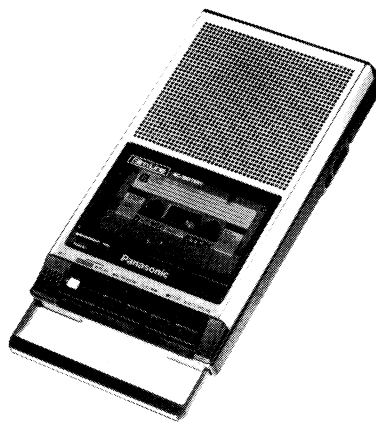
**SATELLITE RECEIVER**, the *System 7XL*, has the performance and operation of the earlier *System 7AR* receiver, with the exception of stereo and a standard remote control. The new unit features detent tuning, a signal-



CIRCLE 116 ON FREE INFORMATION CARD

strength meter, built-in modulator, weatherproof downconverter, 125 feet cable, fixed and variable audio, and operational remote-control capability. It is priced at \$850.00.—**Lowrance Electronics**, 12000 E. Skelly Drive, Tulsa, OK 74128.

**RECORDER**, is a modified, all solid-state Panasonic Slimline AD/DC type designed to provide seven hours of recording and play back on each side of the cassette for a total of 14 hours. Built-in features include voice-level control and digital counter; a TDK DC 180 cassette is furnished. The unit is priced at



CIRCLE 117 ON FREE INFORMATION CARD

\$159.00 plus \$4.00 shipping and handling.

Also available is the AMC 10-hour model with the same features priced at \$95.00 plus \$4.00 shipping and handling.

Accessories include a phone recording adapter that, when connected to the user's phone and the recorder automatically starts the recording when the phone is lifted and stops when it is hung up; and a VOX (voice-activated control switch) that has adjustable sensitivity—voices or other sounds activate the recorder. The recording adapter is priced at \$24.50, the VOX at \$24.95, with a \$1.50 shipping and handling charge for each.—**AMC Sales**, Box 928, Downey, CA 90241.

**EXTRA BASS BOOSTER**, is an amplifier/woofer combination designed for mobile hi-fi

systems that may not have room for an extensive speaker system and equalizers to amplify low-frequency response. The amplifier delivers a maximum of 25 watts of low-frequency power, and four frequency switches allow the user to select the most effective cutoff point between bass and treble.

It is easy to install, and the instructions are printed on the box. The electronic control panel is small enough to fit almost anywhere



CIRCLE 118 ON FREE INFORMATION CARD

under the dash, and the speaker setup may go under a seat or on the rear panel. The *Extra Bass Booster* is priced at \$95.50.—**Tei Electronics**, 570 West 18th Street, Hialeah, FL 33010.

**MULTI-FUNCTION COUNTER**, model *WD-755*, is capable of frequency, period, totalize, ratio, and time-interval measurements. It is a combination of CMOS, TTL, low-power Schottky, and LSI technology. Features include an 8-digit LED display with leading zeroes blanked, automatic input-triggering level, switchable attenuator, selectable

**DESOLDER-IT,  
CLEAN-IT, COAT-IT,  
FREEZ-IT...SEND FOR IT!**  
Our new electronic problem solving catalog  
and **Free Chem-Wik®** samplers!



**Chemtronics**  
681 Old Willets Path  
Hauppauge, NY 11788  
800-645-5244  
In NY 516-582-3322  
Telex 968567

CIRCLE 37 ON FREE INFORMATION CARD

**new** **Vector  
Milliohm Probe**  
**P210**  
Measures Resistances **\$69.50**  
down to 1 Milliohm!  
**USE IN ELECTRICAL AND  
ELECTRONIC CIRCUITRY**

- Verifies contact resistance, measures resistance in solder, wire wrapped, relay, press fit and IDC connections
- Finds opens and shorts in circuit boards
- Finds cable harness faults
- Checks motor and transformer winding shorts
- Ranges:  
30 milliohms, 300 milliohms,  
3 ohms, fine scale  
resolution

Call or write:

**Vector Electronic Company**

12460 Gladstone Ave., P.O. Box 4336, Sylmar, CA 91342-0336  
Phone (213) 365-9661 (Effective January 7, 1984 (818) 365-9661)

CIRCLE 78 ON FREE INFORMATION CARD



# The complete library of replacement semi's.



Here's the one guide that has it all—the new ECG® Master Guide. It's 545 pages, packed with over 3000 ECG semiconductors that replace over 200,000 industry numbers. And our replacements meet or exceed the specs of the original parts. So if it's ECG, you can count on it to fit and work.

Reduce equipment downtime and save yourself endless hours of parts hunting. For everything from analog amplifiers to zener diodes, go with replacement semiconductors from ECG. Get your new ECG Master Guide and our "Counterpoints" product updates from your nearest distributor. For his name and number, call 1-800-225-8326 toll-free (in Massachusetts, dial 1-617-890-6107). Or just send \$3.25 for your ECG Master Guide to Philips ECG, Inc., Dept. RE, 70 Empire Drive, West Seneca, NY 14224.

**If it's ECG, it fits.  
And it works.**

**Philips ECG**

*A North American Philips Company*

CIRCLE 70 ON FREE INFORMATION CARD



lowpass filter, pushbutton reset switch, and rear-panel BNC clock input/output connector. All critical circuits are enclosed in shielded



CIRCLE 119 ON FREE INFORMATION CARD

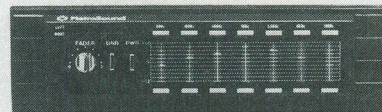
metal chassis to reduce EMI/RFI. The suggested retail price of the model WD-755 is

\$299.00.—**VIZ Mfg. Co.**, 355 E. Price Street, Philadelphia, PA 19144.

**EQUALIZER/AMPLIFIERS**, model *EQ-355* and model *EQ-370* (shown) join the original *EQ-360* electronic pushbutton models that were introduced a year ago.

The model *EQ-355* is a five-band equalizer/amplifier. It offers 36W + 36W, RMS, along with five electronic-pushbutton equalizer controls, 10 LED power readout, preamp line with RCA jacks (high/low impedance), common and floating ground capability, fader balance front or rear, and IC power circuitry.

The model *EQ-370* is a seven-band equalizer/amplifier with built-in DNR and is supplied complete with in-dash mounting trimplate. Pushbuttons provide 12 dB of boost and cut indicated by floating digital readouts,



CIRCLE 120 ON FREE INFORMATION CARD

adjustable sensitivity capacity, and preamp lines in with three-position variable impedance (100mV, 500mV, 3V) through RCA jacks (high/low impedance).

The suggested retail price of each model is \$199.95.—**Metrosound**, 10615 Vanowne Street, North Hollywood, CA 91605.

**MOBILE SCANNER**, model *MX 7000*, has 30 programmable channels with range up to 1.25GHz. In addition, it offers CB, VHF, and UHF TV audio, FM broadcast, all aircraft bands (civil and military), 800MHz communications, cellular telephone, and, when connected to a printer or CRT, satellite weather pictures.



CIRCLE 121 ON FREE INFORMATION CARD

The *MX 7000* computer-controlled keyboard allows the user to program up to 20 channels without a need for crystals. Special features include search, clock, dual scan, and scan or search delay. The unit is supplied with a telescoping antenna, mobile mounting bracket, and an AC adaptor/charger. It is priced at \$599.00.—**Regency Electronics, Inc.**, 7707 Records St., Indianapolis, IN 56226.

**SOUND SYSTEM**, *The Sacramento*, features an AM/FM stereo radio with *ARI* capabilities and an auto-reverse stereo cassette deck. It has a two-channel integral amplifier with seven watts of output per channel, and also includes a low-level output jack for optional attachment of a high-power amplifier. Other features are electronic station-signal



CIRCLE 122 ON FREE INFORMATION CARD

search, pushbutton station selection, and a digital time display. The tape deck includes motorized cassette loading and power-off eject, which automatically ejects a playing cassette when the system is turned off. *The Sacramento* is priced at \$399.95.—**Blaupunkt Division, Robert Bosch Sales Corporation**, 2800 South 25th Ave., Broadview, IL 60153.

R-E

## Electronics Paperback Books NEW Paperbacks You'll Want To Read CHECK OFF THE ONES YOU WANT

**An Introduction to Video**  
\$5.00. Covers most of the practical aspects of video recording that a newcomer to the subject might require.

**Electronic Science Projects**  
\$5.75. Fascinating projects for any science fair. Includes unique clocks, earthquake detectors and more.

**How to Design and Make Your Own PCBs**  
\$5.75. Everything you ever needed to know about how to make printed circuit boards at home.

**The Art of Programming the ZX Spectrum**  
\$7.50. Make this color computer do its stuff. With this book in hand, it's easy.

**Practical Electronic Blocks, Book 1**  
\$5.75. Electronic circuits are all made up of individual building blocks. Make the blocks, then combine them to build the circuits you need.

**The Pre-computer Book**  
\$5.00. Aimed at the beginner with no knowledge of computing. An entirely non-technical discussion.

**20 Programs for the ZX Spectrum & 16K ZX81**  
\$5.00. Included with each program is a detailed flow chart for both games and practical applications in filing, statistics, and engineering.

**30 Solderless Breadboard Projects—Book 2**  
\$5.75. 30 more new projects based on COS-MOS ICs that you can try in minutes on an electronic breadboard.

**How to Get Your Electronic Projects Working**  
\$5.00. When you can't get that home-built equipment to work, this book may have the answers you need.

**ART OF PROGRAMMING THE 16K ZX81**  
\$6.25. What happens when you add the RAM pak, Scrolling, PEEK POKE, Page graphics and more.

**25 Simple Amateur Band Antennas**  
\$5.00. Includes designs for dipoles, beams, triangle and even a mini-rhombic. Includes a complete set of dimension tables.

**EASY ADD-ON PROJECTS FOR SPECTRUM, ZX81**  
\$7.00. Pulse detector, picture digitizer, 5-key pad, model controller, light pen and more.

**International Transistor Equivalents Guide**  
\$7.50. Lists possible substitutes for a popular user-oriented selection of modern transistors. The products of more than 100 manufacturers are included.

**ELECTRONICS SIMPLIFIED—CRYSTAL SET CONSTRUCTION**  
\$4.50. All of these receivers are designed around modern inexpensive components and hand-wound coils.

**BASIC PASCAL IN PARALLEL**  
\$3.75. Develops programs in both languages simultaneously. Sample programs illustrate structure.

**AN INTRODUCTION TO PROGRAMMING THE ORIC-1**  
\$5.00. A new authoritative manual for owners of this new personal computer.

**INTERNATIONAL DIODE EQUIVALENTS GUIDE**  
\$5.75. Find substitutes when you need them for diodes, triacs, thyristors, OC's, photodiodes and display diodes.

**MULTI-CIRCUIT BOARD PROJECTS**  
\$5.00. 21 simple projects that can all be built on one circuit card. Use the same components in several projects.

**INTERNATIONAL TRANSISTOR EQUIVALENTS GUIDE**  
\$7.50. Lists possible substitutes for a popular user-oriented selection of modern transistors. The products of more than 100 manufacturers are included.

ELECTRONIC TECHNOLOGY TODAY INC.  
P.O. Box 240, Massapequa Park, NY 11762

12 838

Number of books ordered ☐

Total Price of Books \_\_\_\_\_

Sales Tax (NY State Residents only) \_\_\_\_\_

Shipping and Handling \_\_\_\_\_

(75¢ 1 or 2 books 30¢ each addl. book)

TOTAL ENCLOSED \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

PRICES GOOD UNTIL MARCH 31, 1984



**ADVANCE  
ELECTRONICS**



IBM-PC<sup>®</sup>  
SOFTWARE  
COMPATIBLE

INTRODUCING THE  
IBM-PC<sup>®</sup> ALTERNATIVE...

THE  **SANYO** MBC550

AT ONLY **\$895<sup>00</sup>** **PLUS**  
REG. \$995<sup>00</sup>

**FREE BUSINESS SOFTWARE**

INCLUDING:

MICROPRO WORDSTAR • CALCSTAR

IUS EASYWRITER

AND THE SYSTEM DISK

• IBM PC Compatible

• Single-Dual Disc Drive

• 128K Memory

• Centronics Printer  
Port Compatible

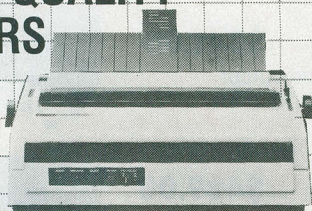
• Color Graphics  
Capability

• 8088 CPU

• Self-Diagnostics

\*IBM PC registered trademark of  
IBM Corporation

LETTER-QUALITY  
PRINTERS



PR 5500

- 16 characters per second
- Bi-Directional printing
- Quiet operation
- Choice of 10, 12 or 15  
characters per inch

**\$795<sup>00</sup>**  
Reg. \$995<sup>00</sup>

not shown

**PR 5000** 10 characters  
per second  
**\$495<sup>00\*</sup>** REG. \$595<sup>00</sup>

\*When purchased with Computer

**SANYO MBC555**

**\$1295<sup>00</sup>** **PLUS**  
REG. \$1395<sup>00</sup>  
DUAL-DISK DRIVE **FREE SOFTWARE**

MICROPRO SOFTWARE (\$2000<sup>00</sup> VALUE)

• WORDSTAR • SPELLSTAR • CALCSTAR  
• MAILMERGE • INFOSTAR

**SANYO MONITOR CRT-36**

MATCHING 12" SCREEN  
HIGH-RESOLUTION  
GREEN MONITOR

**\$169<sup>95\*</sup>**  
REG. \$199<sup>95</sup>

\*When Purchased with Computer



**ADVANCE**

THE PEOPLE  
WHO KNOW

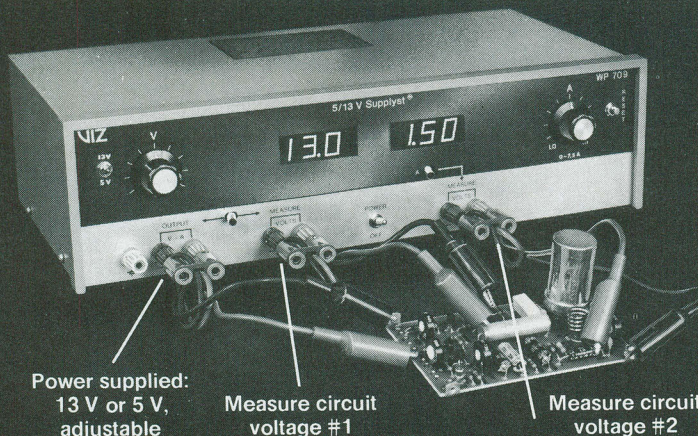
**COMPUTERS**

TOLL FREE HOT LINE  
**800-223-0474**

26 WEST 46th STREET, NEW YORK, N.Y. 10036 212-730-7030



**WP-709.**  
**Double-slot**  
**Supplyst™**  
**power supply.**



Power supplied:  
13 V or 5 V,  
adjustable

Measure circuit  
voltage #1

Measure circuit  
voltage #2

°Outputs: 5V or 13V DC,  
adjustable  $\pm 1\frac{1}{2}$ V  
Zero to 7.5 amp, each voltage.

Two LED displays,  
monitor V or A—  
or two DC voltmeters  
Adjustable current limiting

Only  
**\$339.00**

# DC power to test logic or mobile equipment. Another VIZ Value

## HERE'S REAL PRECISION

Select the precise voltage you want:  
5V or 13V, adjustable  $\pm 1\frac{1}{2}$ V at each  
range. Output is laboratory quality.  
Ripple less than 10mV, peak to peak.  
Regulation better than 0.1%.

## HERE'S REAL POWER

Up to 7.5 amp. at each voltage—

plenty for computer circuits, PA  
systems, mobile transmitters, autos,  
boats, planes.

## HERE'S REAL CONVENIENCE

Front panel controls for instant  
voltage adjustment and precise fine  
adjustment to within 0.1V. Two 3-digit  
LED displays permit continuous

monitoring of both voltage and  
current during use. Current limiting  
control with instant pushbutton reset.

The WP-709 is like two precision  
power supplies for a price less than  
you might pay for one—PLUS two  
digital DC voltmeters.

## VIZ Supplyst™

power supplies with digital displays of voltage and current



**WP-705 \$325.00**

Single output  
0-50VDC. 0-2A.

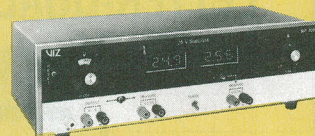


**WP-707 \$423.00**

Dual output  
Two 0-25VDC. 0-2A.

**WP-706 \$341.00**

Single output  
0-25VDC. 0-4A.



**WP-708 \$489.00**

Triple output Two 0-20VDC, 0-2A.  
One 5VDC, 0-4A.

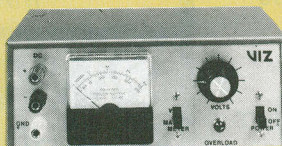


## VIZ DC power supplies

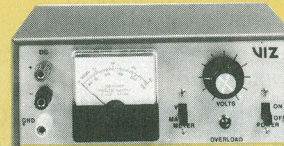
Fully regulated, continuously adjustable voltage  
outputs with short circuit protection.  
Analog meters and overload indicators.



Dual WP-702A Two 0-20VDC. 0-200mA **\$167.00**



Single WP-703A  
0-20VDC. 0-500mA **\$119.00**



Single WP-704A  
0-40VDC. 0-250mA **\$125.95**

### VIZ RELIABILITY

VIZ is a 50 year-old company. Our instruments are  
fully warranted, parts and labor, for a year.  
All items tested to NBS standards. We offer service and parts  
availability for a minimum of ten years. Over 15 repair depots in U.S.A.

Want full technical details and a demonstration? Call toll-free. **1-800-523-3696**, for the VIZ distributor nearest you



**Look to VIZ for value, quality, availability.**  
**Over 70 instruments in the line—PLUS full accessories.**

VIZ Mfg. Co., 335 E. Price St., Philadelphia, PA 19144



# BUILD THIS

## Video Accessory

# Color Processor/ Noise Filter



ROGER COTA and LLOYD ADDINGTON

*Here's an inexpensive add-on device  
that you can use to create professional fades, reduce noise,  
and correct color errors in video recordings.*

IF YOU OWN A VIDEOCASSETTE RECORDER (VCR) then you are no doubt familiar with the problems of making high-quality recordings. No matter how hard you try, you end up with washed out colors, glaring reds, and other assorted problems. It gets even worse when you record from one tape to another. But those problems can be remedied easily and inexpensively with the video color processor we'll describe here. You'll find that tapes with their color properly restored, their video noise reduced, and with the look of professional editing will be much more enjoyable to view than those you're probably looking at now. And not only that—you can actually save money using the processor by using less tape. That's because you can use slower recording speeds and still obtain acceptable results.

While the color processor can be used for several applications, it's perhaps most useful when recording from one tape to another. You can correct some of the first tape's color distortion and insert fades-to-

blacks, where appropriate, to get what looks like a professionally edited tape. That's especially helpful for making home movies.

You can also use the processor when recording off-the-air programs. But the processor does not contain its own RF modulator and it has no audio input. Therefore you'll need an enhancer, a second VCR, an RF modulator with an audio input, or a monitor with a composite-video input so that you can see the results of the processing.

### Features

This color processor is designed to let you correct color and contrast errors, create professional quality fade-ins and fade-outs, and eliminate unwanted colors and video noise. You can do those things by using the front-panel TINT, FADER, LEVEL, and BACKGROUND controls—they let you manipulate the picture color and brightness in ways that you cannot with a TV set or monitor alone.

Proper restoration of skin tones and balance of color hues is the function of the TINT control. The FADER control allows adjustment of the picture level from black (0%) to full luminance (100%), and can be used in editing for fading to black or fading from black to full luminance. Color saturation of the picture can be reduced to black-and-white or increased to full color by adjusting the LEVEL control. Unwanted noise in the picture background can be virtually eliminated or background colors can be intensified by adjusting the BACKGROUND control.

Another control, FLASH FILTER, is provided so you can eliminate the problem of single-color dominance that is often present in bright pictures. A PROCESS/BYPASS switch is included so that you can bypass the processor while still leaving it in-line. Finally, a graduated PICTURE LEVEL LED meter lets you monitor the output level.

The processor is powered by 12 volts DC. We used a wall transformer with a 12-



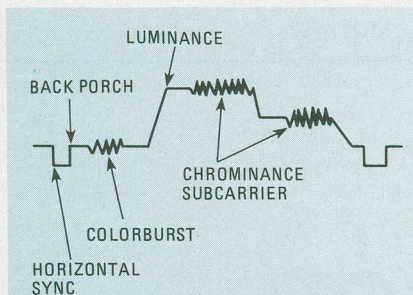


FIG. 1—A COMPOSITE COLOR-VIDEO SIGNAL contains luminance and chrominance information as well as horizontal sync pulses.

volt DC, 300-milliamp output to convert the line voltage to that level. If you want to use the processor for portable applications, such as when using a video camera, you can power it with a 12-volt battery pack.

### About the circuit

Before we can talk about the circuit of the color processor, we have to introduce you to a composite video signal, as shown in Fig. 1. As you can see, it is composed of two unrelated signals: *luminance* and *chrominance*. Those signals are processed independently in the color processor and are mixed together again before they are output.

The luminance (or black-and-white) signal contains the picture (or brightness) information. The chrominance (color) signal contains the hue and saturation information. It is used to modulate a subcarrier frequency of 3.58 MHz. That subcarrier is then used to amplitude modulate the video carrier.

Also contained in the chrominance signal is a *colorburst* that is sent to synchronize the receiver's color circuits with the color that is being transmitted. The colorburst is sent during the horizontal blank-

## PARTS LIST

All resistors ¼ watt, 5% unless otherwise specified.

R1, R25, R55, R89—100 ohms  
R2, R39—75 ohms B  
R3, R9, R32, R71, R75—150 ohms  
R4—27,000 ohms  
R5, R11, R36, R48, R101—22,000 ohms  
R6, R12, R13, R20, R47, R63, R65, R73, R87, R96—1000 ohms  
R7, R16, R17, R40, R41, R58, R59, R67, R68, R72, R74, R76, R77, R85, R99, R103, R106—470 ohms  
R8, R26, R84, R91—1500 ohms  
R10, R19, R54, R79, R80, R97, R98, R104—10,000 ohms  
R14, R37, R38, R42, R78—220 ohms  
R15, R21, R29, R34, R53, R64, R95, R100—2200 ohms  
R18, R94—680 ohms  
R22—6800 ohms  
R23, R27, R93—4700 ohms  
R24, R88—15,000 ohms  
R28, R56, R57, R66, R83, R92, R102—3300 ohms  
R30, R35, R105—22 ohms  
R31, R82, R86—2,000 ohms, potentiometer, linear taper  
R33, R49, R90—47,000 ohms  
R43, R62, R107—330 ohms  
R44—56 ohms  
R45—1 megohm  
R46—5600 ohms  
R50—750 ohms  
R51, R52—33,000 ohms  
R60—560 ohms  
R61—390 ohms  
R69—20,000 ohms  
R70—12,000 ohms  
R81—10,000 ohms, potentiometer, linear taper

### Capacitors

C1, C2, C6, C11—22  $\mu$ F, 10 volts, electrolytic  
C3, C40—470  $\mu$ F, 10 volts, electrolytic  
C4—5-55 pF trimmer capacitor  
C5, C10, C17—22 pF, 50 volts, ceramic disc

C7, C18, C41, C42—0.1  $\mu$ F, 50 volts, ceramic disc

C8—68 pF, 50 volts, ceramic disc  
C9—100 pF, 50 volts, ceramic disc  
C12, C20 through C24, C26, C29, C30, C32, C35 through C38—.05  $\mu$ F, 50 volts, ceramic disc  
C13—680 pF, 50 volts, ceramic disc  
C14—.01  $\mu$ F, 50 volts, mylar  
C15, C31—130 pF, 50 volts, ceramic disc  
C16—.001  $\mu$ F, 50 volts, ceramic disc  
C19—10 pF, 50 volts, ceramic disc  
C25—56 pF, 50 volts, ceramic disc  
C27, C28—180 pF, 50 volts, ceramic disc  
C33—220 pF, 50 volts, ceramic disc  
C34, C43—100  $\mu$ F, 10 volts, electrolytic  
C39—470  $\mu$ F, 35 volts, electrolytic

### Semiconductors

IC1—7808 8-volt positive regulator  
Q1—Q5, Q8, Q9, Q11, Q12, Q16—Q19, Q21—Q23, Q25, Q27, Q28, Q32, Q33, Q35—Q39—2N3904  
Q6, Q7, Q10, Q13—Q15, Q20, Q24, Q26, Q29—Q31, Q34—2N3906  
D1—D9, D11—1N914 or 1N4148 diode  
D10—1N4004  
LED1—LED4—red LED's  
J1, J2—RCA-type phono jack  
J3—miniature phone jack  
L1—33  $\mu$ H, high-Q inductor  
S1, S2, S3—SPDT toggle switch  
**Miscellaneous:**  
117-volts AC to 12-volts DC, 300-mA wall transformer; printed circuit board.

The following are available from Video Control, 3314 H Street, Vancouver, WA 98663 (1-206-693-3834): Complete kit including PC board, wall transformer, case, and all parts for \$139.00. Drilled and plated circuit board \$28.50. Power adapter (wall transformer) \$10.00. Please add \$3.50 for postage and handling; WA residents add state and local taxes as applicable. Allow four (4) weeks for delivery.

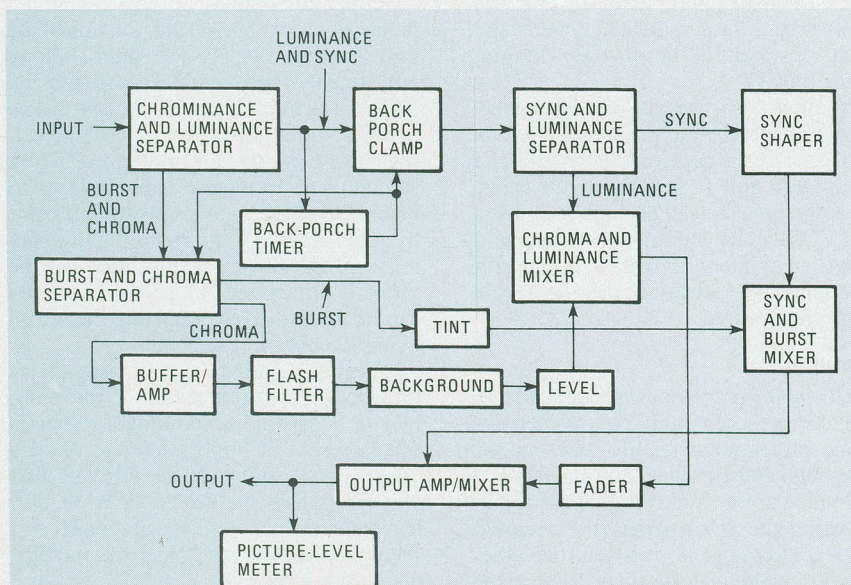


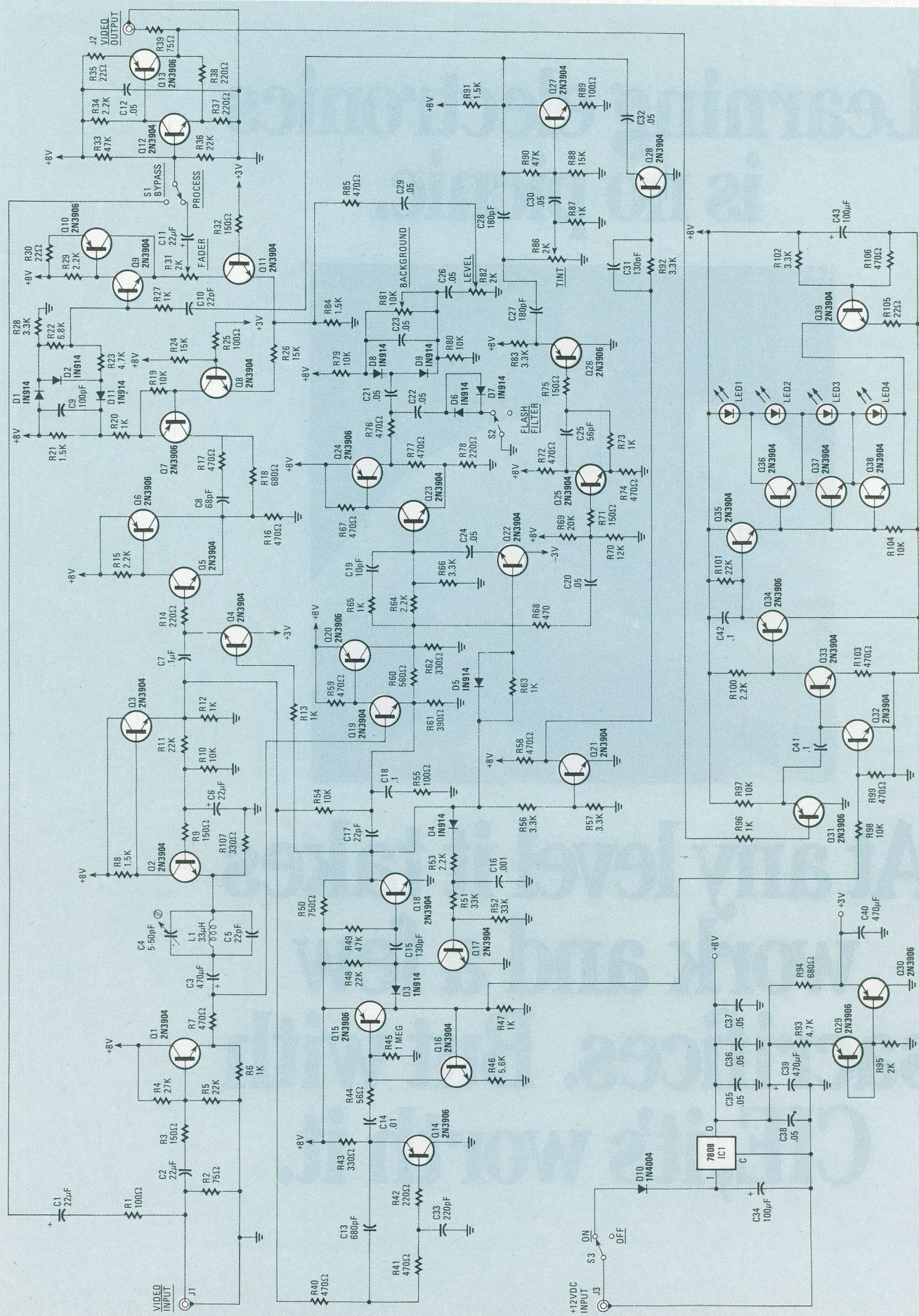
FIG. 2—BLOCK DIAGRAM OF THE COLOR PROCESSOR shows how the luminance and chrominance are processed separately.

ing interval (when the electron beam snaps back across the screen). It can be thought of as a reference for interpretation of the color information.

We should take a closer look at the information contained in the chrominance signal: the hue and saturation. The hue is commonly called color, while saturation has to do with how pure a given hue is (how much white it contains). The hue that your set displays is determined by the phase relationship between the color subcarrier and the colorburst. The color processor's TINT control lets you adjust that phase and thus the hue. The saturation is determined by the amplitude of the chrominance carrier. That can be adjusted by the LEVEL control.

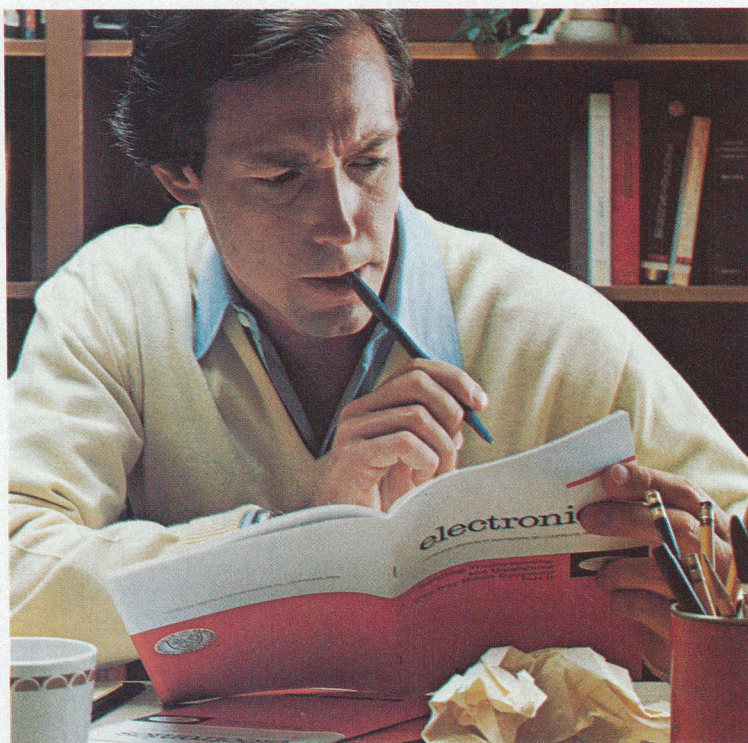
A block diagram of the color processor is shown in Fig. 2 and its schematic is shown in Fig. 3. Video input enters the chrominance/luminance separator and is broken up into a luminance-and-sync signal and a chroma-and-burst signal. Let's







# Learning electronics is no picnic.



## At any level it takes work and a few sacrifices. But with CIE, it's worth it.



Whoever said, "The best things in life are free," was writing a song, not living a life. Life is not just a bowl of cherries, and we all know it.

You fight for what you get. You get what you fight for. If you want a thorough, practical, working knowledge of electronics, come to CIE.

You can learn electronics by spending some hard-working time at home. Or, would you rather go bowling? Your success is up to you.

At CIE, you *earn* your diploma. It is not handed to you simply for putting in hours. But the hours you do put in will be on your schedule, not ours. You don't have to go to a classroom. The classroom comes to you.

### Why electronics training?

Today the world depends on technology. And the "brain" of technology is electronics. Every year, companies the world over are finding new ways to apply the wonders of electronics to control and program manufacturing, processing...even to create new leisure-time products and services. And the more electronics applications there are, the greater the need will be for trained technicians to keep sophisticated equipment finely tuned and operating efficiently. That means career opportunities in the eighties and beyond.

### Which CIE training fits you?

Beginner? Intermediate? Advanced? CIE home study courses are designed for ambitious people at all entry levels. People who may have:

1. No previous electronics knowledge, but do have an interest in it;
2. Some basic knowledge or experience in electronics;
3. In-depth working experience or prior training in electronics.

You can start where you fit and fit where you start, then go on from there to your Diploma, an Associate Degree if you want it, and career.

### Many people can be taught electronics.

There is no mystery to learning electronics. At CIE you simply start with what you know and build on it to develop the knowledge and techniques that make you a specialist. Thousands of CIE graduates have learned to master the simple principles of electronics and operate or maintain even the most sophisticated electronics equipment.

### CIE specializes in electronics.

Why CIE? CIE is one of the largest independent home study schools that specializes in electronics. Nothing else. CIE has the elec-

tronics course that's right for you.

Learning electronics is a lot more than memorizing a laundry list of facts about circuits and transistors. Electronics is interesting! It is based on recent developments in the industry. It's built on ideas. So, look for a program that starts with ideas and builds on them. Look to CIE.

### Programmed learning.

That's exactly what happens with CIE's Auto-Programmed® Lessons. Each lesson uses famous "programmed learning" methods to teach you important principles. You explore them, master them completely, before you start to apply them. You thoroughly understand each step before you go on to the next. You learn at your own pace.

And, beyond theory, some courses come fully equipped with electronics gear (the things you see in technical magazines) to actually let you perform hundreds of checking, testing, and analyzing projects.

### Experienced specialists work closely with you.

Even though you study at home, you are not alone! Each time you return a completed lesson, you can be sure it will be reviewed, graded, and returned with appropriate instructional help. When you need additional individual help, you get it fast and in writing from the faculty technical specialist best qualified to answer your question in terms you can understand.

### CIE offers you an Associate Degree.

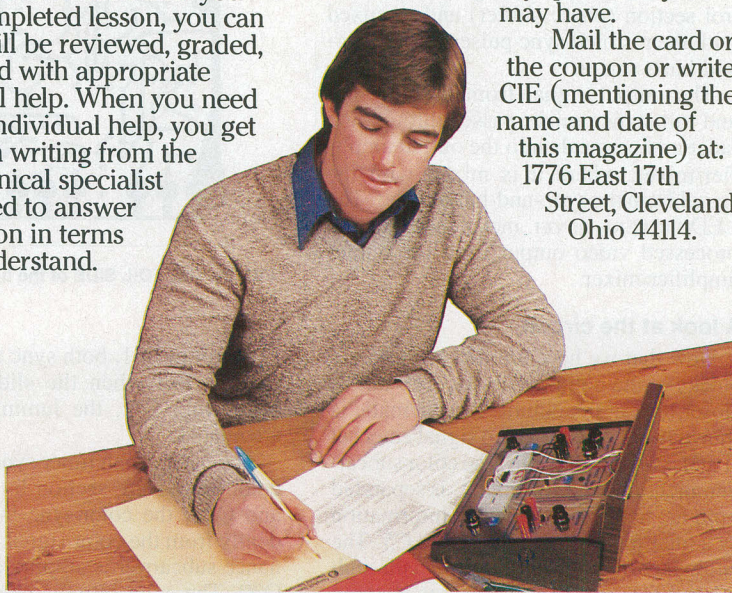
One of the best credentials you can have in electronics — or any other career field — is a college degree. That's why CIE gives you the opportunity to earn an Associate in Applied Science in Electronics Engineering Technology. Any CIE career course can offer you credit toward the degree...more than half of the number needed in some cases.

You can also prepare for the government-administered FCC (Federal Communications Commission) Radiotelephone License, General Class. It can be a real mark in your favor...government-certified proof of your specific knowledge and skills.

### Today is the day. Send now.

Fill in and return the postage-free card attached. If some ambitious person has removed it, cut out and mail the coupon. You'll get a FREE school catalog plus complete information on independent home study. For your convenience, we'll try to have a CIE representative contact you to answer any questions you may have.

Mail the card or the coupon or write CIE (mentioning the name and date of this magazine) at:  
1776 East 17th  
Street, Cleveland,  
Ohio 44114.



## CIE Cleveland Institute of Electronics, Inc.

1776 East 17th Street, Cleveland, Ohio 44114

Accredited Member National Home Study Council

RE-74

YES...I want to learn from the specialists in electronics — CIE. Send me my FREE CIE school catalog...including details about the Associate Degree program... plus my FREE package of home study information.

Print Name \_\_\_\_\_

Address \_\_\_\_\_ Apt. \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Age \_\_\_\_\_ Area Code/Phone No. \_\_\_\_\_ / \_\_\_\_\_

Check box for G.I. Bill bulletin on Educational Benefits: ☐ Veteran ☐ Active Duty

**MAIL TODAY!**



first see what happens to the luminance-and-sync signal.

The luminance-and-sync signal goes to both the back-porch timer and the back-porch clamp. (The back-porch timer is a circuit that detects the sync pulse. It tells both the back-porch clamp and the burst-and-chroma separator when to begin their action.) From the back-porch clamp, the signal enters the sync-and-luminance separator. The luminance signal is sent to be mixed with the processed chroma signal in the chroma-and-luminance mixer. The sync pulses are properly restored in the sync shaper and are sent to be mixed with the processed burst signal in the sync-and-burst mixer.

Now we'll look at how the burst and chroma signals are processed. After the burst-and-chroma signal is separated from the luminance-and-sync signal, they are sent to the burst-and-chroma separator (Q22 and Q28). That separator acts like a switch that is controlled by the back-porch timer. The chroma subcarrier is sent through the buffer amplifier and then passes through the flash-filter, background-, and level-control sections. The processed chroma signal is then mixed with the luminance.

The burst passes through the tint-control section (phase shifter) and is mixed with the restored sync pulses in the sync-and-burst mixer.

The output signal from the chroma-and-luminance mixer passes through the fader and proceeds into the output amplifier/mixer, where it is mixed with the signal from the sync-and-burst mixer. The LED PICTURE LEVEL meter monitors the processed video output from the output amplifier/mixer.

### A look at the circuit

Now that we have an idea of the basic blocks of the color processor, let's take a closer look at the circuit. Its schematic is shown in Fig. 3. The video signal enters at J1 and is buffered by Q1. The color subcarrier, including the colorburst, is separated from the luminance and sync information by a filter made up of L1, C4 and C5. The luminance and sync are amplified through Q2 and Q3, and the DC level is restored by Q4, which clamps the video at the back-porch level. The back-porch timer (made up of Q14, Q15, Q16, Q17, Q18) generates a pulse during the back porch of the signal at Q3. That pulse tells the luminance-and-sync separator and the burst-and-chroma separator when to start their action.

The sync and luminance are separated by Q5, Q6, Q7, and Q8, and sent to the luminance-fader circuit and the sync-restoration circuit. The sync is amplified and shaped by Q7 and diodes D1, D2, and D11, and is then sent to Q9 and Q10, which feed the top of the FADER control. The luminance is amplified by Q11 and is fed to the other side of the FADER control. When the slider of R31 moves toward the

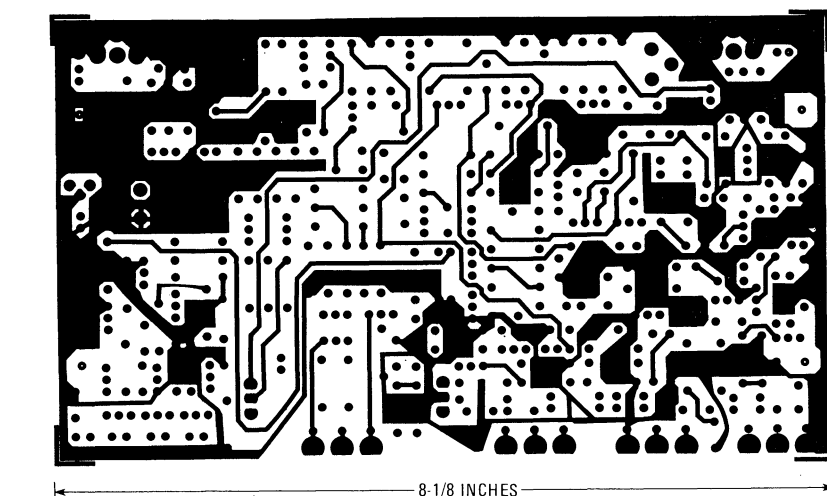


FIG. 4—The component side of the processor board is shown half size.

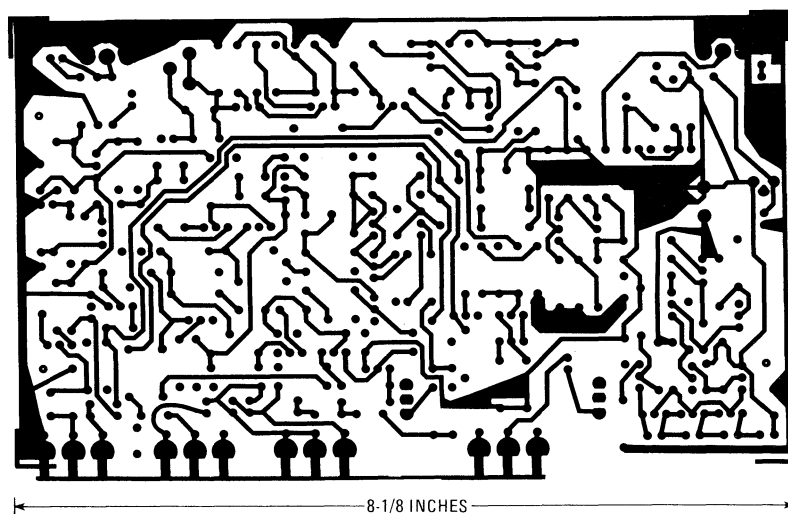


FIG. 5—THE FOIL SIDE of the board is shown here half size.

collector of Q11, both sync and video are passed. But when the slider is moved away from Q11, the luminance will be attenuated.

The back-porch timer synchronizes the color-processing section by gating (Q22 and Q28) the color-sync burst independently from the color signal. The chrominance subcarrier is amplified by Q19 and Q20. The color burst is phase shifted by Q25, C25, and R73. The TINT control (part of a variable phase-shift network) composed of R86, C27, C28, and Q27 gives additional control over the phase shift. The color burst is then mixed back with the sync pulses through C10 and R27 and is fed to Q9. The remainder of the chrominance subcarrier is amplified by Q23 and Q24 and then limited by D6 and D7, the FLASH FILTER. After limiting, the background-noise gating diodes D8 and D9, whose bias is controlled by R81, set an amplitude that is adjusted to block out low-level noise. The LEVEL control, R82, adjusts the amount of color carrier. The chrominance signal is then mixed back in with the luminance at the emitter of Q11. The output of the FADER control feeds the

output amplifier Q12, Q13, and then to the video output J2. From the output of Q13 the total signal is amplified by Q31 and goes to the meter-drive circuit. The signal is clamped at Q33 by Q32 (driven by a timing pulse from the sync separator, Q15). That gives a reference level for amplifier Q33. The signal is amplified and rectified through Q34, which drives the display circuit made up of Q35, Q36, Q37, Q38, and LED1—LED4.

### Construction

A double-sided printed-circuit board is definitely required for this project so that stray capacitance is kept to a minimum. Half-size foil diagrams are shown in Figs. 4 and 5. Figure 6 shows a parts-placement diagram.

A few construction tips are in order. When installing parts, it's important that all parts are inserted in their correct place. (That may seem too obvious to say, but *double check* your work!) Make sure you watch out for polarity, too, especially with transistors, diodes, and electrolytic capacitors. It is also important that all leads be kept as short as possible, because of the



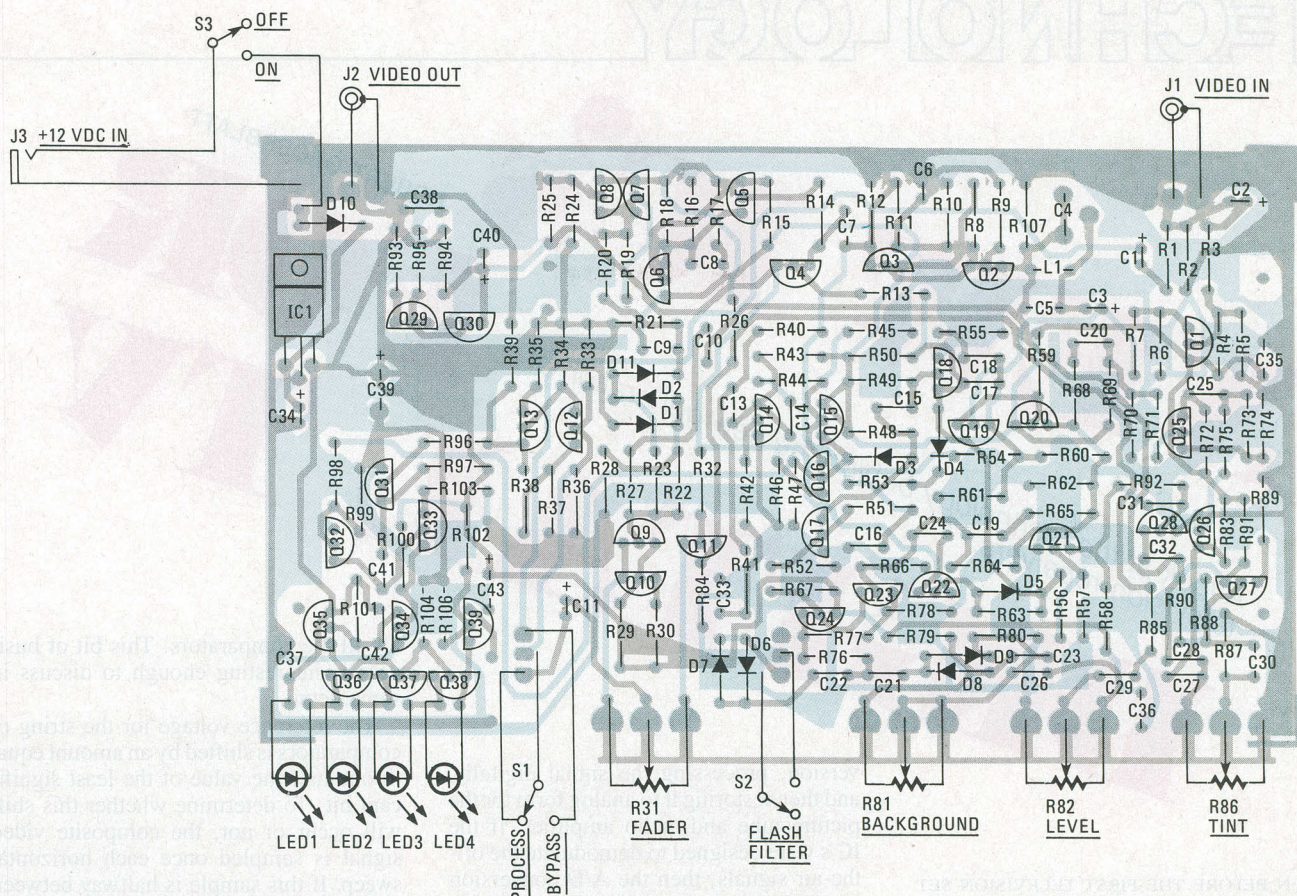


FIG. 6—PARTS-PLACEMENT DIAGRAM. Note that the voltage regulator, IC1, is mounted to the foil with a nut and bolt.

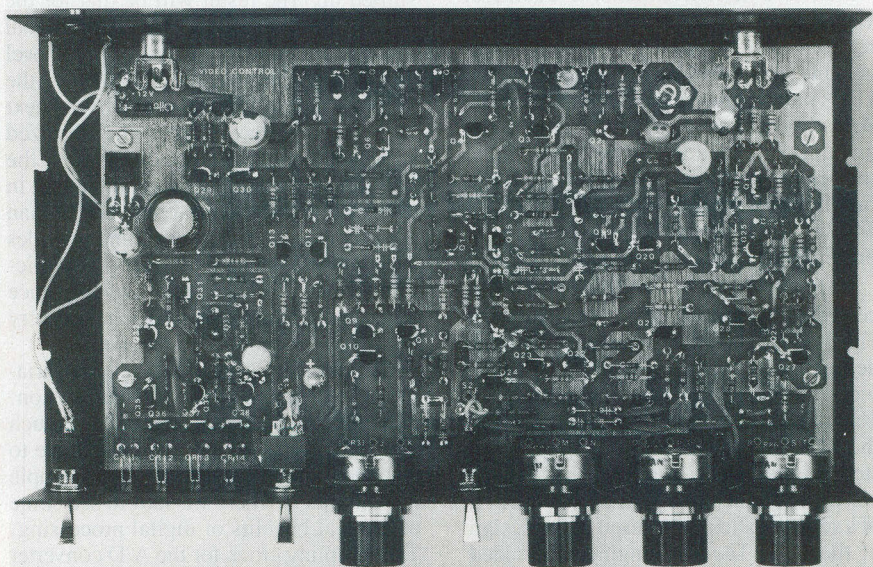


FIG. 7—A METAL CASE IS NECESSARY to ensure shielding. The potentiometers and phono jacks are mounted directly to the board without interconnecting wires.

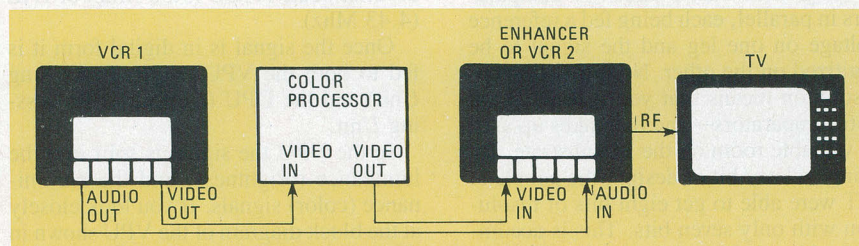


FIG. 8—ONE POSSIBLE HOOKUP for the color processor is shown here.

high frequencies involved. Be careful when you solder. Avoid cold solder joints and remove any flux residue with alcohol after soldering. Then you can inspect the board to make sure that there are no solder bridges between the traces.

The project should be mounted in a metal case to ensure shielding. One possible method is shown in Fig. 7. However, before you place the cover on the chassis, you have to calibrate C4. To do that, you'll have to hook up the unit as shown in Fig. 8. Connect the VIDEO IN jack of the unit to the VIDEO OUT jack of VCR1. Connect the VIDEO OUT jack of the processor to the VIDEO IN jack of VCR2. (If you do not have a second VCR, you can use an enhancer or an RF modulator.) Connect the enhancer's output or the RF output of VCR2 to the TV's antenna input. For calibration, the front-panel controls of the processor should be set as follows: Power switch in ON position, PROCESS/BYPASS switch in PROCESS position, FADER control at 12 o'clock (adjust for slight flickering of 100% PICTURE LEVEL LED), FLASH FILTER in OFF position, BACKGROUND control fully counter-clockwise, LEVEL control fully counter-clockwise, and TINT control at 12 o'clock. After completing the preliminary adjustments, C4 can now be calibrated. Adjust C4 until color disappears and only a black-and-white picture is on the TV screen. Now the processor is properly calibrated.

R-E



# NEW IC's FOR DIGITAL TV

ROBERT GROSSBLATT

A look at the technology behind the new generation of television receivers.

EVEN BEFORE THE FIRST TELEVISION SET was rolling off the production line more than thirty five years ago, engineers were hard at work looking for ways to reduce the parts count in the second set. When LSI (Large Scale Integration) techniques made it possible to squeeze more than 70,000 transistors into an IC, television engineers were able to produce whole subsections of TV circuitry on a single silicon chip. This was, however, all analog circuitry. Digital electronics was only used for peripherals such as keyboard scanning, and bells and whistles such as time and channel displays.

VLSI (Very Large Scale Integration) has more than quadrupled the possible component density on a single chip and this state-of-the-art IC fabrication technology has resulted in a real breakthrough in consumer television design. ITT has invested more than two hundred man-years of highly specialized and expensive labor to produce a set of 5 VLSI IC's designed to be used as the processing heart of a digital television set. These new IC's are intended to replace more than 300,000 transistors and, together with some support circuitry, will mean the elimination of more than 25 IC's in conventional television circuits.

Now, digital TV in this case doesn't mean digital transmission or reception of some new type of signal. These IC's are meant to process the baseband audio and video signals in the television receiver—regular analog circuitry will still be needed to demodulate the off-the-air signals. The IC set works by doing A/D con-

version, processing the signal digitally, and then restoring it to analog form for the picture tube and audio amplifier. If the IC's were designed to demodulate the off-the-air signals, then the A/D conversion would have to be performed on signals with a top end around one gigahertz, which is a tricky, expensive business. Using analog circuitry in the front-end reduces these frequencies down to a manageable size. This was a smart move on ITT's part because it vastly simplified the A/D conversion circuitry, reduced the amount of needed R&D time, and, more important, kept the cost of the IC set at manageable levels—presently about \$40.00. (Unfortunately, these IC's are not presently available in low quantities.)

A block diagram of a typical TV receiver using the digital IC's is shown in Fig. 1. Once the incoming signal has been demodulated by the tuner, the composite video is fed to the VCU (Video Codec Unit). Figure 2 shows a block diagram of the VCU. The A/D conversion is the first step in the VCU. It's done by a flash converter and it's here that we see the first of a series of slick tricks used in the design of the IC's. The ITT engineers decided that eight bits of resolution were needed, but this can use up a healthy amount of silicon. This is because a flash converter is nothing more than a bunch of comparators in parallel, each being fed a reference voltage on one leg and the signal to be digitized on the other. Now, eight bits of resolution means that you'll need 2<sup>8</sup>, or 256 comparators—and that takes up a lot of valuable room on the IC substrate. By using a clever bit of design, the people at ITT were able to get eight bits of resolution with only seven bits. This is accomplished by shifting the reference voltages

for all the comparators. This bit of business is interesting enough to discuss in some detail.

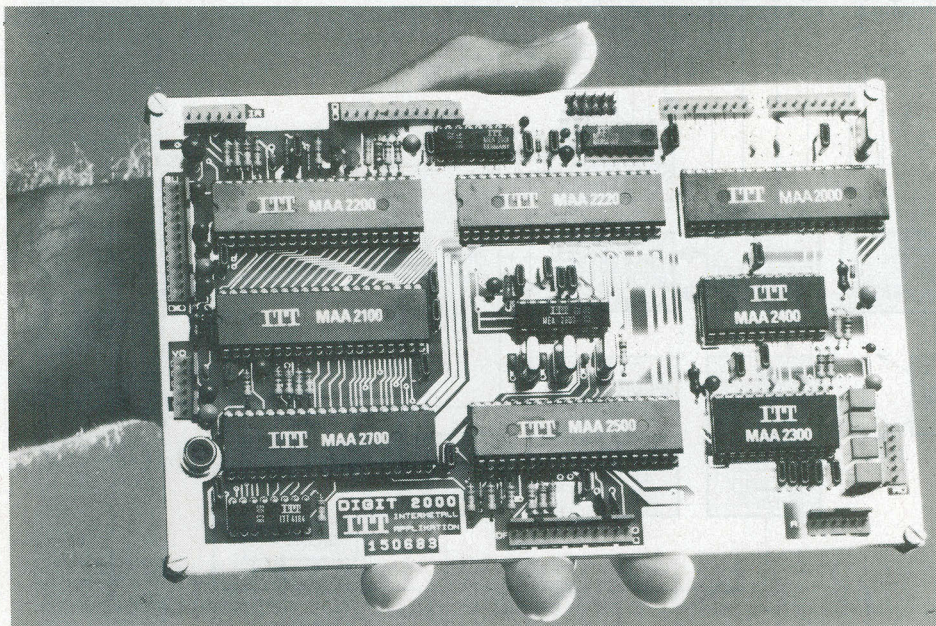
The reference voltage for the string of comparators is shifted by an amount equal to one-half the value of the least significant bit. To determine whether this shift will occur or not, the composite video signal is sampled once each horizontal sweep. If this sample is halfway between two digital levels, then the reference level during the *next* horizontal line will be shifted up. The result will be that for the present horizontal line, the video signal will be converted to the lower digital level and during the next horizontal line, the video signal will be converted to the next higher digital level. When the digitized signals are converted back to analog, the D/A converter undergoes a similar shift in sync with the A/D converter. The human eye averages these two levels and provides an intermediate level as seen on the picture screen. This approach is valid since video information does not change very rapidly from one line to the next.

The number of bits isn't the only variable in this, or any other, A/D conversion. Not only do you have to decide how much you're going to sample, you also have to decide how often you're going to sample it. And this is where we start to see some of the real benefits of digital processing. The sampling clock for the A/D converter is phase-locked to the broadcast colorburst frequency. By changing the frequency of the clock, therefore, the system can accommodate NTSC (3.58 Mhz) or PAL (4.43 Mhz).

Once the signal is in digital form it is fed to both the VPU (Video Processing Unit) and the DPU (Deflection Processing Unit).

In the VPU the signal is split into the luminance (brightness) and the chrominance (color) signals. If you look closely at the block diagram of the VPU shown in Fig. 3, you'll recognize most of the stan-





standard signal-processing stages of a conventional TV receiver. In the luminance path, the signal goes through a chroma trap and peaking filter to improve the high-frequency response. This results in enhanced brightness and definition, and is controllable by the user in eight steps. The signal is passed on to a series of digital multipliers for the appropriate contrast setting, and a limiter that watches the

voltage and clips the amplitude if the signal gets too strong. The seven-bit digital luminance signal is then fed back to the Y/D/A converter in the VCU.

In the chrominance channel, the signal goes through the chroma bandpass filter for IF compensation. The amplitude of the signal is controlled by circuitry that keeps comparing the signal to an internally generated reference voltage. By

doing this, the filter is perfectly phase linear and makes sure that the IF compensation is constantly being corrected. The circuitry that follows is a digital version of standard video-signal processing. The filter leads to an automatic color-control circuit, a color killer, and a color decoder. This is where things start to get interesting again. For NTSC and PAL, the blue and red signals are 90 degrees apart on the

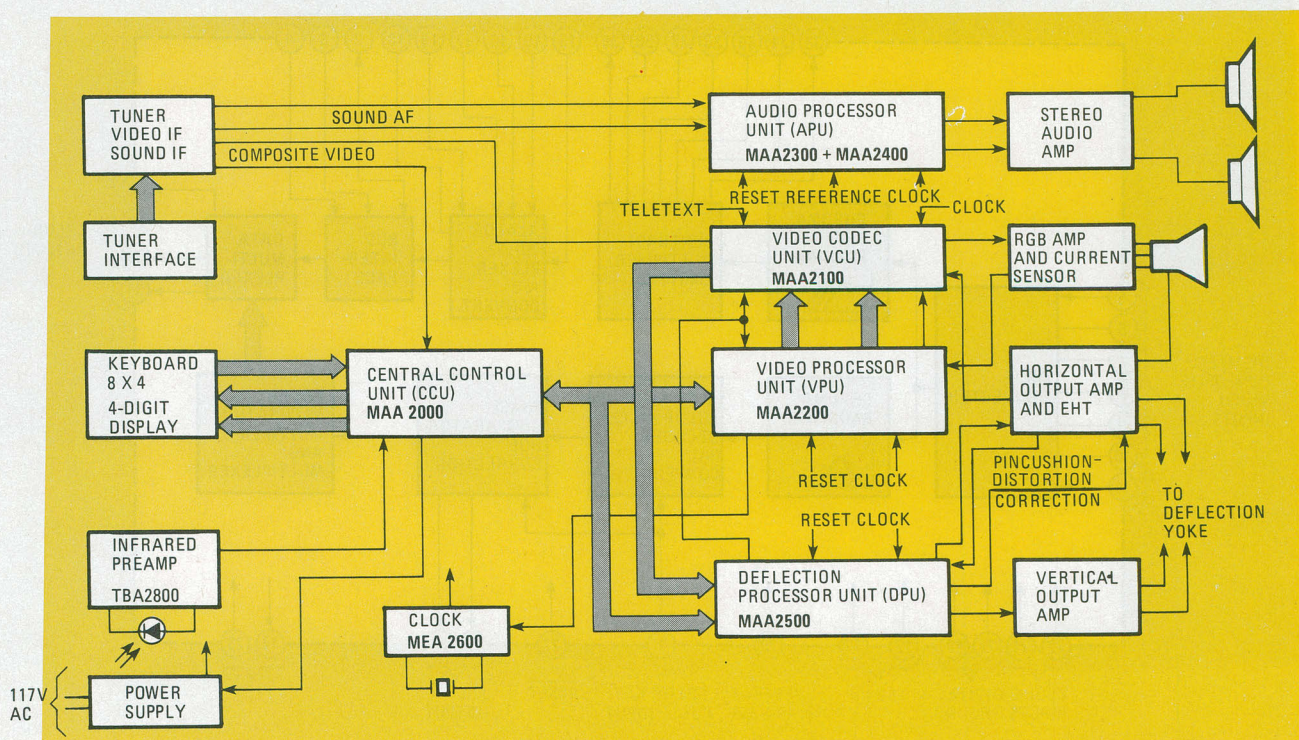


FIG. 1—ALTHOUGH ANALOG SIGNALS are fed in and analog signals come out, all the signal processing is done digitally in this new TV set. Note that the ADC is part of the APU block above.



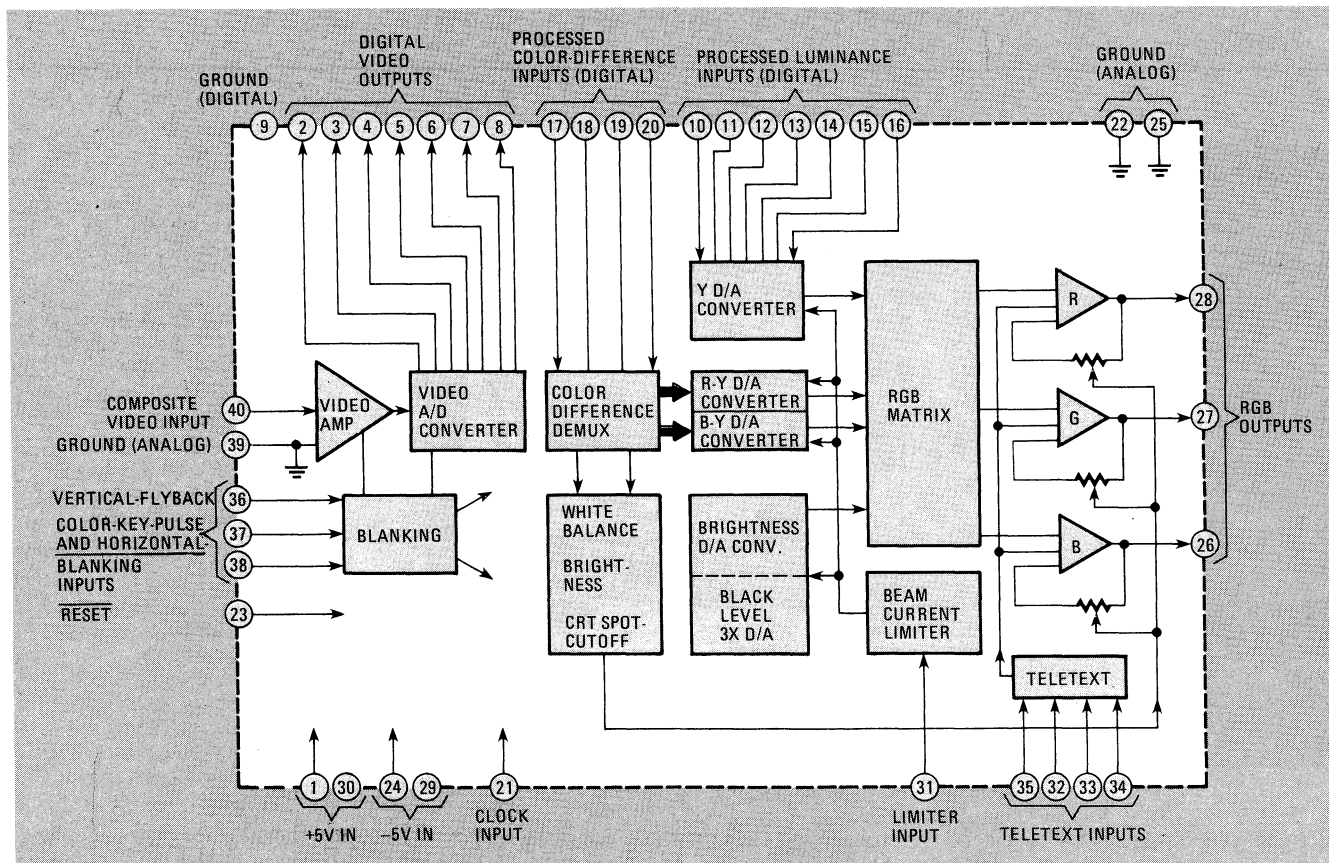


FIG. 2—THE VCU performs the analog-to-digital conversion of the video signal as well as the digital-to-analog conversion. This IC also processes the video signal into separate R-G-B analog outputs.

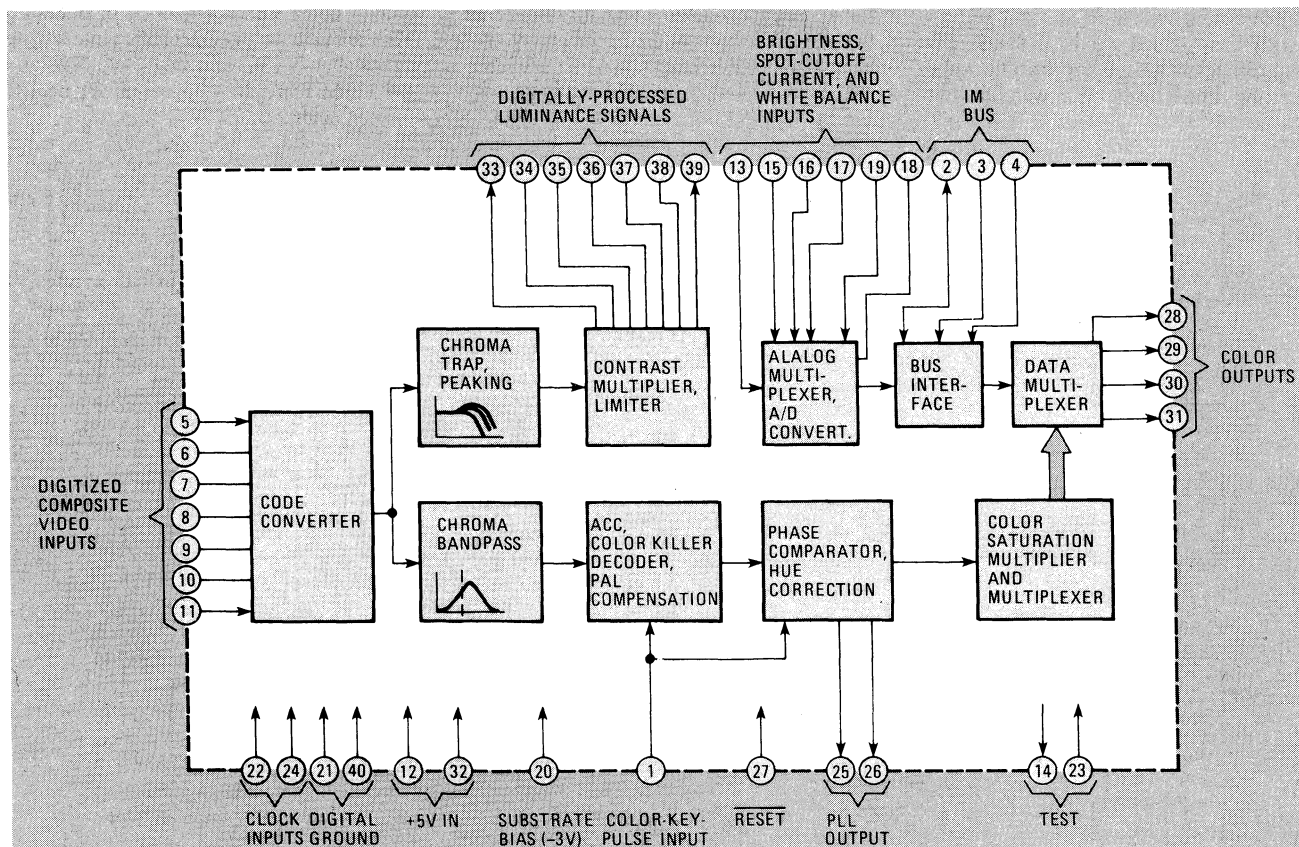


FIG. 3—COLOR AND LUMINANCE processing is done by the VPU IC. This IC can handle both PAL and NTSC signals.



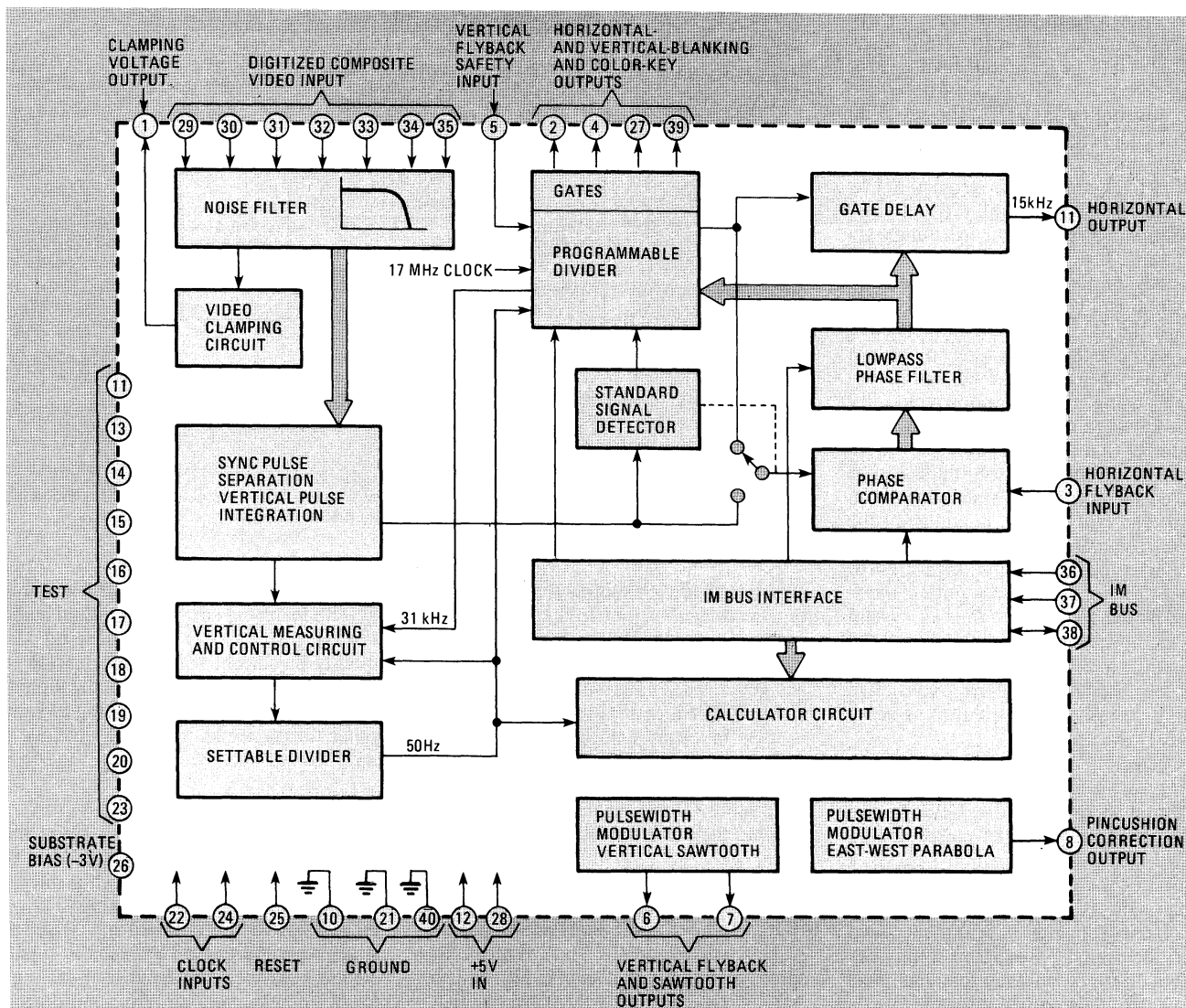


FIG. 4—THE DPU handles the deflection processing and has a unique way of coping with sync signals.

carrier and are amplitude modulated. SECAM, however, sends the blue and red signals separately on alternate horizontal sweeps and frequency modulates them on the carrier. The CCU (Central Control Unit) tells the color decoder what sort of TV signal it's looking at and decodes it into the proper blue and red components. The circuit that follows this is the compensation network for PAL signals. Since this phase compensation isn't needed for NTSC signals, the compensation circuit does double duty by using its delay lines as a comb filter when the circuitry is processing NTSC signals. Because the signal is in digital form, however, conventional analog delay lines aren't used. The VPU contains some RAM to emulate the delay by temporarily storing the signal for a number of clock pulses before passing it along to the next stage of video processing.

Since the red and blue information has been extracted from the signal, this is the point in the signal path where it's possible to check that the processor clock and the broadcast signal are in phase with each other. A digital phase-locked loop com-

pares the blue signal in the decoded video with the red signal in the broadcast colorburst. Any phase difference found there is going to be proportional to the phase difference between the system clock and the colorburst. As in any phase-locked-loop system, an error voltage is generated. In this case, the error voltage is in digital form and is used to adjust the system clock so that TV sync is checked against broadcast sync on every horizontal line! Hue correction is done next by rotating the demodulation axis, using sine and cosine values in real time. The sine and cosine values are provided by the CCU in response to a user-adjusted front-panel HUE control. The corrected chroma signals are multiplied, multiplexed (to cut down the number of pins needed on the IC package), and put back on the bus to the VPU.

In the VCU, the signal is demultiplexed and fed to separate R-Y and B-Y D/A converters for restoration to analog form. These converters are resistive ladders of the R-2R type. An analog RGB matrix is used to convert these color and luminance signals into conventional RGB

form and they are fed into individual RGB output amplifiers. One interesting point here is that the VCU has separate inputs for teletext featuring their own brightness and contrast settings. The VCU also monitors the beam current drawn by the picture tube. As the tube ages, the current is adjusted and kept at a constant level. The effects of picture tube aging are therefore cut way down and the useful life of the tube is greatly increased.

### Deflection circuits

Things really start to get intriguing when we take a look at the deflection circuits. The DPU (Deflection Processor Unit) is the IC that takes the digitized video and produces all the sync and timing signals. A block diagram of the DPU is shown in Fig. 4. As we single-step our way through this amazing piece of silicon, you'll see why digital video processing can lead to some truly amazing things.

The first thing the incoming seven-bit signal sees is a video clamping circuit that holds the black level to a fixed voltage during flyback. Since we've already seen that there are limiters to cut excessive



signal elsewhere in the circuitry, it's important to maintain a really rigid black level. This lets the incoming analog video swing across the full range of the video A/D converter in the VCU. The seven-bit video signal is fed in parallel to the DPU, has the noise filtered out by a digital lowpass filter, and sync is stripped out by separate horizontal- and vertical-sync separators. From here on in, things get fascinating. In theory, since the colorburst frequency is always in a fixed ratio to horizontal and vertical sync, it's possible to have the IC do some arithmetic and constantly check sync against colorburst. What this means is that sync can be derived by using some countdown circuitry that is keyed to the colorburst frequency. Remember that the system clock is set to exactly four times the colorburst and is checked and corrected on each horizontal sweep. The clock, then, contains all the information needed to produce all the necessary sync information, regardless of whether or not sync is accurately transmitted by the TV station. The ITT system uses the horizontal sync pulse to tell the DPU when to expect the sync pulse. The DPU can, however, tolerate one or two missing pulses and its stability in noisy signals is excellent.

By detecting colorburst and constantly locking the system clock to the broadcast colorburst frequency, the DPU knows where and when the sync pulses should appear. After all, horizontal sync is a function of the colorburst frequency and vertical sync is a function of horizontal sync. It's just a matter of arithmetic. As a result, the digital TV set isn't totally dependent on the broadcaster for sync—this is most definitely something new!

The DPU handles horizontal sync in two ways—locked and non-locked. If horizontal sync shows up where it's supposed to, the DPU operates in the locked mode and the broadcast sync pulse triggers an internally generated sync pulse that is passed on to the rest of the processing circuitry in the IC. The correct phase is guaranteed because the countdown circuitry lets the IC know when to expect the sync pulse. If the countdown is done and horizontal sync doesn't show up, the IC goes into the non-locked mode and generates horizontal sync all by itself. The switching between locked and non-locked operation is done on each horizontal line of video. The IC also does a check to see whether the phase of the horizontal sync pulse is correct by comparing it to the flyback. If a discrepancy is detected, the countdown timer, which is programmable, is corrected.

Vertical sync operates pretty much the same way. Horizontal sync is counted down and the IC knows when to expect the vertical sync pulse. If it shows up on time, all well and good—if it doesn't show up, the IC generates it. Strictly speaking, all sync pulses are generated by the IC. If the broadcast is standard, (ie,

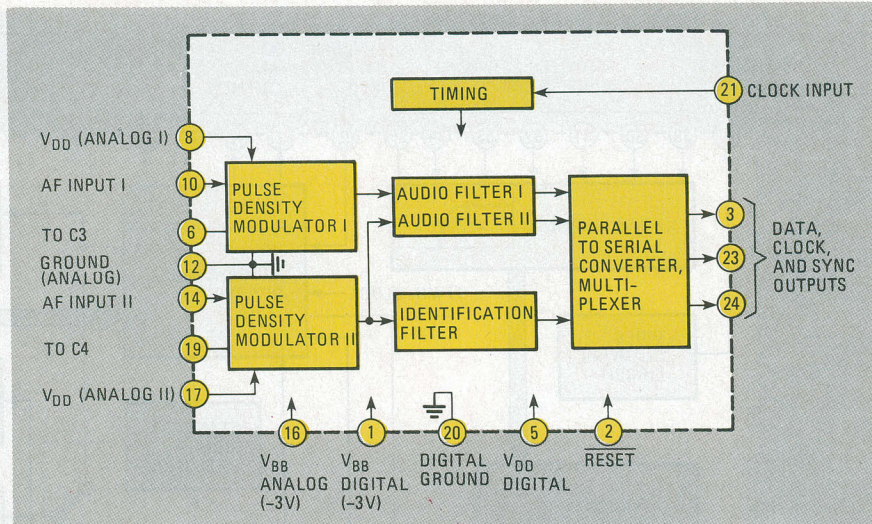


FIG. 5—THE AUDIO SIGNAL is converted into digital form by the ADC. This IC also has provisions for identifying whether the signal is broadcast in mono, stereo, or bilingual.

sync pulses are where they should be), the broadcast sync signal triggers the IC to produce a pulse. When things are non-standard or off-spec, the IC detects this and generates sync at the appropriate time all by itself. Since a fairly narrow window is used to catch sync, spurious signals such as those caused by airplanes or electric appliances won't have any effect on the picture. This goes a long way toward keeping the picture rock solid.

### The audio signal

The audio is handled by two IC's—the ADC (Audio Digital Converter) and the APU (Audio Processor Unit). A block diagram of the ADC is shown in Fig. 5. The ADC is basically an A/D converter that takes the audio signal from the tuner and converts it to a 16-bit digital signal at a 35-kHz conversion rate. The ADC identifies the signal that indicates whether sound is being broadcast in mono, stereo, or bilingual, and then multiplexes the parallel audio data into serial form to be passed to the second IC in the audio section—the APU.

A block diagram of the APU is shown in Fig. 6. The overall block diagram of the TV receiver in Fig. 1 shows the APU and ADC as a single block labelled APU. The APU has two paralleled, identical sections so to be able to handle either stereo or mono broadcasts. Processing in the IC is done in real time and the sequencing is done by a controlling algorithm in an on-board ROM. This means that changing the data in the ROM will enable the IC to economically handle different stereo standards. A tiny RAM is also onboard to store user settings such as loudness, tone, and so on. Although ITT doesn't mention it in their literature, these two audio IC's could easily be the heart of a separate digital audio system composed of just a handful of silicon. Since these IC's are designed to look at analog audio and output pulse-width-modulated signals, it

wouldn't take much to produce a sound system featuring completely digital audio signal processing. Considering the quality of current sound transmission in broadcast television, the use of the digital-TV audio subsection for handling FM and other things seems a natural—but we'll have to wait and see.

### System control

The brains behind the chip set is the CCU (Central Control Unit). This is basically an eight-bit single chip microcomputer—more specifically an 8049. A  $96 \times 8$  EARM is onboard and is used to store preprogrammed TV channels, (up to 30 are possible), preferred user settings for brightness, volume, etc.; and during manufacture of the TV set, all the alignment data can be written in. Every time the TV is turned on, the alignment data can be read out to the TV circuitry so factory-fresh alignment is always available. Component aging is just not the problem it is with conventional analog circuitry. It will be rare for alignment problems to show up. This arrangement becomes very important when the set has to be serviced. The technician will have a handheld unit with which he can check settings and make any adjustment to the data in the EARM that is indicated. Performance upgrades could very well be simply a matter of altering the program in the EARM. In theory this could be done without taking the back of the set off and should allow such currently impossible things as a ten-second conversion of the set from PAL to NTSC or vice versa.

The CCU also handles the TV controls from either an infra-red remote control or a front panel keyboard. Up to 32 keys can be decoded and that should be more than enough for even the most die-hard knob twiddler. Several output ports on the CCU can directly drive LED displays and handle additional features such as automatic station search and so on.



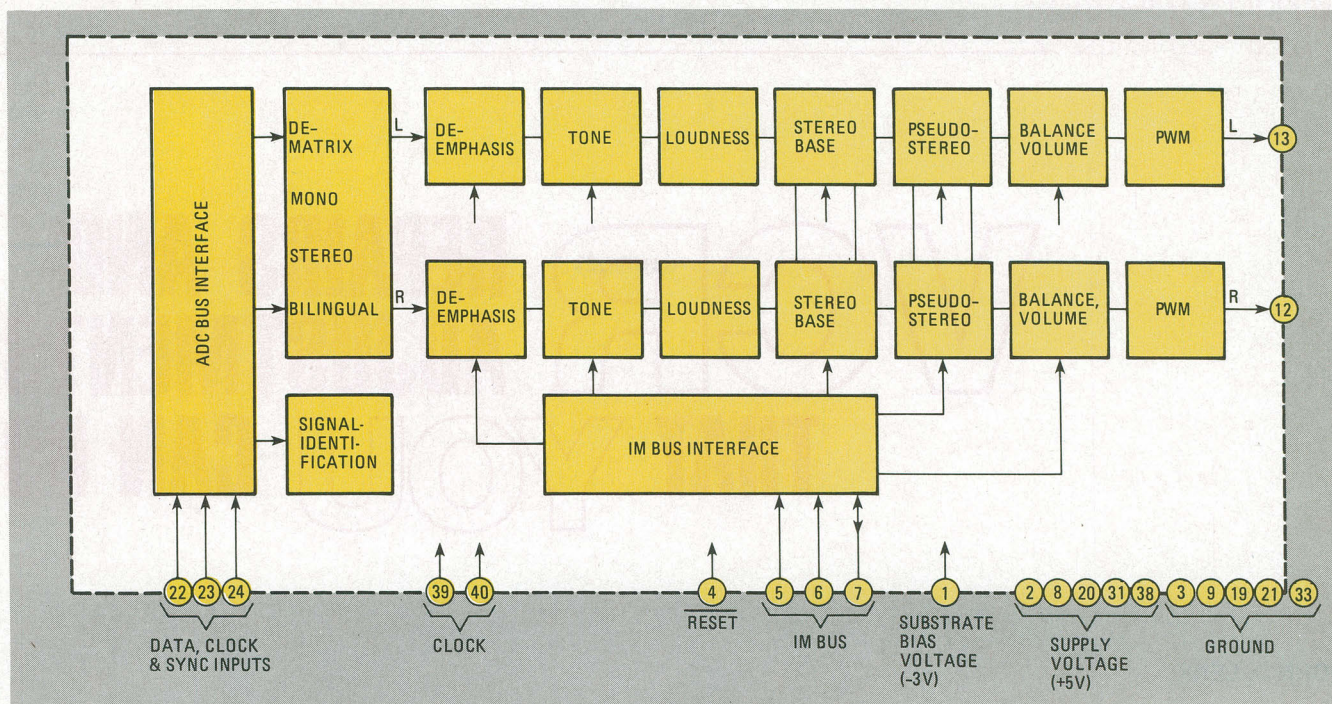


FIG. 6—THE APU handles such functions as tone, loudness, volume, balance, etc., and does it with two independant audio channels.

The clock-generator IC is crystal controlled and delivers the two phase, non-overlapping pulses used by the rest of the circuitry. As we've already seen the VCO (Voltage Controlled Oscillator) in this IC is part of the digital phase-locked-loop contained in the VPU. This arrangement makes it possible to sync the system clock to the broadcast colorburst. It also means that the same clock IC can be used for either NTSC (14.32 MHz) or PAL (17.73 MHz). If these numbers look strange, remember that the clock is designed to run at four times colorburst. The basic clock frequency is fed to a pulse shaper to produce the two-phase clock signal and buffers are used to convert it to a low impedance output.

### Advantages of digital TV

Now that we understand how digital TV works, let's talk a bit about some of the things it can do. To start off with, we've already seen that the same TV can receive either PAL or NTSC signals. Now, there may not be too many of you out there who are planning on a move to Europe but I'll bet there are a lot of you who are using earth stations. If this benefit seems a bit limited, there are other advantages. A bit of extra silicon will produce picture store. For those of you without VCR's it means that you can do a freeze frame during actual transmission. But picture store goes a lot farther than that. It includes such goodies as zooming, picture within picture (seeing a different channel in the corner of the screen), easy conversion between different standards, and so on.

We can take this last bit a little farther since, in theory, interpolation techniques could be used to create as many lines as you want. There is a breakeven point, but adjacent lines could be averaged to produce new "in-between" lines of video. Either averaging or real bit interpolation could be used. This would go a long way toward correcting one of the worst features of large-screen, projection TV. Some work has already been done on this by ITT but it was found that moving objects tend to blur. This doesn't rule out digital enhancement, however, but it does mean that some sort of processor-controlled motion-sensing circuitry is needed to change the interpolation algorithm for moving objects.

Picture store can also be used to reduce the flicker caused by current interlace methods and increase the apparent resolution of the picture. This is simply a matter of reading out the picture at a higher rate than the picture is produced. TV engineers have known for quite a while that the resolution seen in today's conventional sets is much lower than even a 525 line picture scan should be able to produce. A good part of the reason for this is that only half the total scan lines are on the screen for each field of video. Digital TV can eliminate the interlace by storing all 525 lines and then displaying the completed picture on the screen all at once. This picture would be continuously displayed until the next full picture was ready to be put on the screen. This would give you 30 images a second—movies get by with 24.

People plagued by poor reception in weak-signal areas would have their lives

made a lot easier by easily added noise-reduction circuitry (remember, this is digital signal processing), and ghosting can be reduced by using echo cancelling.

TV manufacturers are constantly touting new features and calling them revolutionary. Well, they're often innovative and creative, but "revolutionary" is a strong word. Digital TV is, however, revolutionary—it's a brand new way to process video and, even as it stands now, it opens the door to features that are just not possible with conventional analog circuits. The current eight-IC set will undoubtedly be reduced in number.

At the moment, ITT is alone in producing an IC set for Digital TV. Most of the other semiconductor manufacturers in the field seem to be taking a wait-and-see attitude—and this is understandable. The design and development of the IC set is only a part of the economic question of whether digital TV can compete with traditional circuitry. Producing VLSI IC's with their enormous component densities is a difficult and complicated process. Remember that VLSI techniques have only been around for a few years. Whether it can be done efficiently and economically in a high-volume operation is a question still looking for an answer. Product reliability in the field is another parameter that has yet to be determined. Mass production of an IC set as complicated as ITT's current design hasn't ever been done on the sort of scale needed for consumer applications. If everything works out, however, ITT will be way ahead of everybody else and will enjoy a well-deserved lead in the marketplace. **R-E**



# VCR REPAIRS AND ADJUSTMENTS THAT YOU CAN DO

JOHN D. LENK

SO YOU WANT TO TRY SERVICING VCR'S? On the other hand, maybe you would just like to know how to make some simple adjustments to improve VCR performance or some sure-fire troubleshooting to quickly pinpoint VCR problems. Well, we'll start this article by saying there are no such tricks or simple adjustments! Servicing any VCR takes all the skill and knowledge required to service any TV set or tape recorder. More important, all VCR adjustments, particularly mechanical adjustments, are critical. An improper mechanical adjustment can not only put a VCR out of commission, but can result in permanent damage to the VCR or cassette.

Now that we have duly frightened you, let us go on to discuss what practical steps you can take in VCR servicing, without hassle, and with a minimum of danger. Before we start, however, let us set a few ground rules. First off, we will assume that you are thoroughly familiar with TV, both color and black-and-white, and with magnetic tape recorders. We also assume that you can use all forms of test equipment and tools associated with TV and tape-recorder service. If the above is not true, you probably have no business trying to service a VCR.

Now let us review how VCR's, both Beta and VHS, operate. We will not go into full circuit descriptions or mechanical details (to do so would fill a book, let alone a magazine article), but we will go through VCR functions so that you can understand the theory-of-operation sec-

*Repairing and aligning VCR's isn't easy, but it is possible to do some of the work yourself if you know how! In this article we'll tell you what repairs and adjustments you can make using standard test equipment.*

tions found in VCR service literature.

## The basic VCR circuit

Figure 1-a is a block diagram of a basic VCR circuit. Note that a VCR is a form of VTR, or videotape recorder. VTR's have

been used in the television industry since about 1955 to record programs. Based on the same electromagnetic principles as an audio-tape recorder, a VTR has the ability to record on magnetic tape, and later play back, video signals coming from a video

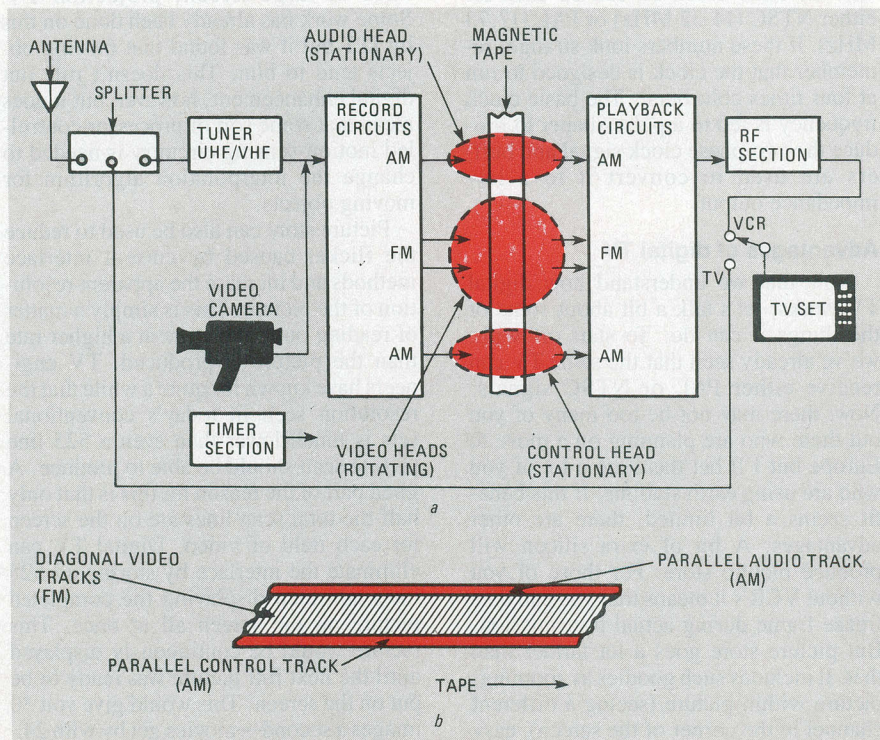
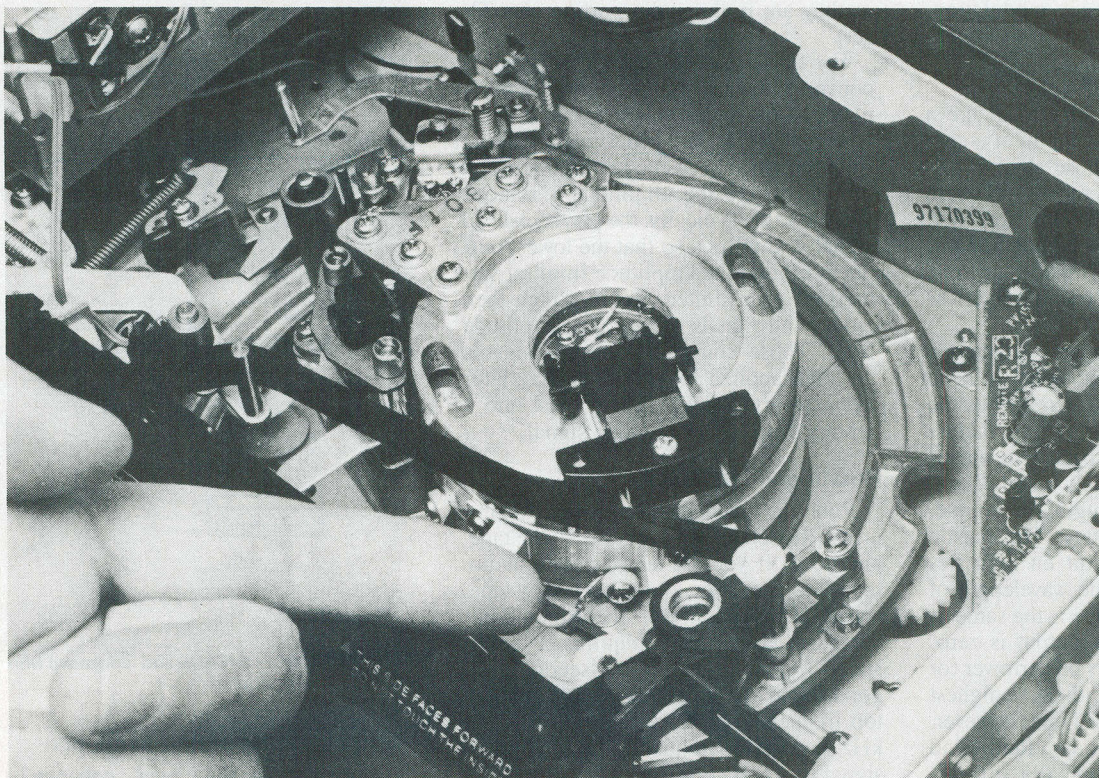


FIG. 1—SIMPLIFIED BLOCK DIAGRAM of a home VCR is shown in a. How that VCR records tracks on a tape is shown in b





camera or a TV station. That process is called video recording, and has many advantages over older TV recording processes and over motion-picture film. For example, both picture and sound can be recorded at the same time; there is no need for developing or processing the tape after recording; long-term preservation is possible; many recordings can be made using the same tape over again; continuous recording and playback are possible over relatively long periods of time, and a VTR or VCR is relatively compact and easy to use.

As shown in Fig. 1-a, a typical consumer VCR includes a tuner (VHF and UHF), an RF section, a timer section, and a mechanical section (including tape transport, stationary audio head, stationary control head, and rotating video heads). The same heads used for recording are also used for playback, and there are two rotating heads (typically) for video record/playback, whereas there is only one audio head and one control head.

The tuner section is similar to tuners found in TV sets, and functions to convert broadcast signals picked up by the antenna to frequencies and formats suitable for use by the VCR. All TV channels, 2 through 83, are covered by the tuner. Typically, tuner output to the recording circuit is 1 volt (P-P) for video, and 0 dB (0.775 volt) for audio.

The recording circuits function to convert the tuner output into electrical signals used by the heads to record the corresponding information on the magnetic

tape along tracks. There are three tracks as shown Fig. 1-b (audio, video, and control or synchronization). Note that the audio and control tracks are parallel to the tape, whereas the video track is diagonal. As we will discuss later, the video track is recorded diagonally to increase tape-writing speed, and thus increase the bandwidth as is necessary to record video signals.

The playback circuits function to convert information, recorded on the tracks and picked up by the heads, into electrical signals used to modulate the RF section. In the simplest of terms, the RF section is a miniature TV broadcast station with its output on an unused TV channel (typically Channel 3 or 4, but possibly 5 or 6). The output of the RF section is applied to the TV set.

During operation, you select the channel you wish to record, using the VCR tuner controls. That need not be the channel watched on the TV set. (In fact, the TV set need not even be on while recording on the VCR.) You then turn on the timer and the program (or programs) are recorded.

When you are ready to play back the recorded program, you select the appropriate unused channel using the TV's channel-selector controls. Then you turn on the timer and play back the program using the TV set as a display device.

Many present-day VCR's also provide for recording directly from a video camera and microphone. Those are connected to the VCR's recording circuits at the

same point that the tuner would be. Once the material is recorded, operation of the VCR during playback is the same, no matter what the recording source (off-air programming or video camera).

### Why VCR circuits are so complex

The diagram shown in Fig. 1-a is, of course, greatly oversimplified. Although a VCR is essentially a tape recorder, there are two unique problems associated with them that are not found in audio tape recorders. Those two problems result in very complex circuits, as well as precision mechanical assemblies for both Beta and VHS VCR's.

One of the problems is the high video frequencies (4 to 5 MHz) used in TV. It is not practical to record those frequencies on tape using familiar audio-frequency techniques. The other problem is that there must be precise synchronization of video and audio during both record and playback.

Now let us see how these problems are solved in a present-day consumer VCR.

### Recording the video signal

Recording the audio and control tracks is relatively simple when compared to recording the video signals. The control signals are typically 60 Hz, whereas the audio signals rarely go below about 20 Hz or above 20 kHz. The techniques used in audio-tape recorders are adequate for both of these signals. However, typical video signals can range from DC (0 Hz) up to about 4.2 MHz.



There are three methods used to increase the frequency range (or increase writing speed) that a VCR can handle—small head gaps, frequency modulation, and rotating heads.

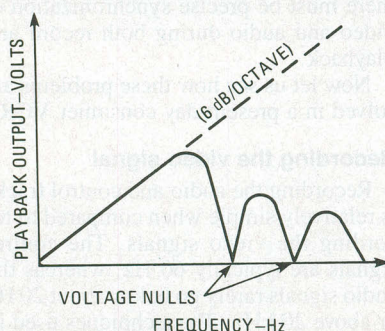
### Small video-head gaps

The recording heads in a VCR are a form of electromagnet made up of a core wrapped with a coil. Those electromagnets are made so that the north and south poles are placed physically close together. But no matter how close together they are, there is always a small space, or gap, between them. That space is referred to as the head gap.

Both record and playback frequency limits are inversely proportional to head gap (the frequency limit increases as the gap decreases). Thus, all other factors being equal, a smaller head gap means shorter-wavelength signals can be handled. A shorter wavelength, of course, means a higher frequency. The reason head gaps place that limit on high frequencies is that when the wavelength of the signal recorded on tape is the same as gap width, the playback output is zero. Thus the gap must always be narrower (or shorter) than the wavelength of the highest frequency to be recorded. Note, however, that although present-day video-head gaps are very small (typically 0.6-micrometer for Beta and 0.3-micrometer for VHS), there is an obvious physical limit on how small you can make a practical video head. Thus, other methods of increasing the frequency range must also be used.

### FM recording and playback

The output voltage of any tape playback head varies in amplitude with changes in frequency; Fig. 2 shows that relationship. If only a narrow portion of the frequency range is used, as is the case with audio recording, you can ignore the amplitude variations. However, with video (where the highest frequency is about 200 times that of audio), the wide variation in amplitude produces a playback output (at the head) that is totally distorted compared to the recorded signal. An FM recording has no variation in amplitude (theoretically) and any amplitude variations that do oc-



**FIG. 2—PLOT OF FREQUENCY versus output voltage for a typical playback head. Note that over a wide frequency range, as is the case with a video recording, the variations in amplitude can cause unacceptable distortion.**

cur in either record or playback can be virtually eliminated by limiters and amplifiers that are driven into saturation (just as they are in the audio portion of a TV set).

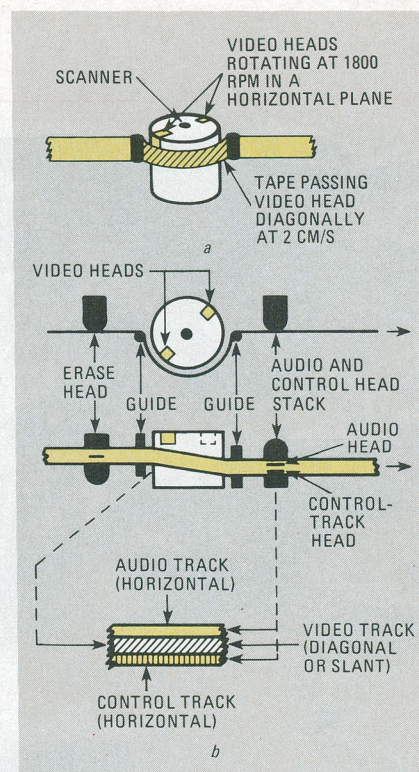
For those reasons, the video signal is converted to an FM signal by an FM modulator before recording on tape in a VCR. Upon playback, the FM signals coming from the video heads go to amplifiers and limiters where the amplitude variations are removed. Typically, the playback head signal is amplified so that the lowest output is beyond the amplitude limit (at saturation) of a limiter circuit, which then reduces all signals to the same amplitude level. Those constant-amplitude signals are then applied to an FM demodulator that converts the FM signal back into a replica of the original video signal.

### Rotating video heads

Rotating video heads are used to increase the relative speed between the tape and head. If you are familiar with audio tape recording, you know that a slow tape speed is sufficient for recording conversation, but music requires a faster speed (typically 19 cm-per-second) for good sound quality. If you assume that the top frequency for recording music is 20 kHz, that the top frequency limit for video signals is 4 MHz (200 times that of audio), and that a 19-cm-per-second tape speed is sufficient for good quality for audio, the required tape speed is 3800 cm-per-second ( $19 \times 200 = 3800$ ) or 38 meters-per-second. This works out to about 2280 meters-per-minute, and would require a video cassette the size of a truck tire (or very thin tape) for only one hour of playing time!

Instead of running the tape at a high speed, the video heads are rotated to produce a high relative speed between head and tape. Figure 3 shows how the heads and tape move in relation to each other. While the video heads rotate in a horizontal plane as shown in Fig 3-a (on a drum in Beta and on a cylinder in VHS), the tape passes the heads diagonally. That is known as a helical scan system, and produces slant tracks or diagonal tracks for the video recording.

Note that the audio head and control-track head (mounted one above the other on a stack as shown in Fig. 3-b) are stationary, and are separate from the video heads, as is the erase head. That arrangement is typical for both Beta and VHS. However, because of different drum or cylinder size, the relative speed of the Beta system is typically 6.9 meters-per-second (273.2 inches-per-second), whereas the typical VHS relative speed is 5.8 meters-per-second (228 inches-per-second), even though the actual tape speed is in the range of 2 cm-per-second. Also note that the drum or cylinder (often referred to as the scanner) rotates at a speed of 1800 rpm for both Beta and VHS.



**FIG. 3—HOW VIDEO HEADS and tape move with relation to each other.**

### Video signal recording sequence

Figure 4 shows the typical sequence in recording and playback of the luminance (black-and-white) signal on a VCR. During recording, the entire luminance signal (from sync tips to white peaks) is amplified and converted to an FM signal that varies in frequency from about 3.5 to 4.8 MHz (for Beta) or 3.4 to 4.4 MHz (for VHS). During playback, the FM signal is demodulated back to a replica of the original luminance signal. Note that this provides an FM luminance bandwidth on tape of about 1.3 MHz for Beta and 1 MHz for VHS.

TV color information is transmitted on the 3.58-MHz chrominance subcarrier. Color at any point on the TV screen depends on the instantaneous amplitude and phase of the 3.58-MHz signal. In VCR's, the 3.58-MHz subcarrier is heterodyned or down-converted to a frequency of 688 kHz (Beta) or 629 kHz (VHS), and is then recorded directly (AM, not FM) on tape. That system is known as color-under, because the color signal frequency is always well below the luminance signal frequency.

### Tracks, fields, frames

As shown in Fig. 5-a, video heads A and B are positioned 180° apart on the drum or cylinder, which rotates at 30 rps. The tape is wrapped around the drum or cylinder and passes diagonally across the surface to produce the helical scan. Since there are two heads, each head contacts the tape once each 1/60 of a second, so each head completes one rotation in 1/30 of a second, and one video track is recorded on the tape during half a rotation (1/60



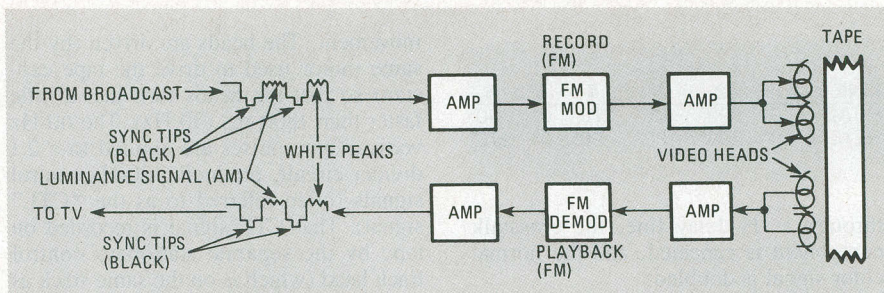


FIG 4—THE SEQUENCE FOLLOWED in recording and playing back a luminance signal in a typical VCR. Note that the same heads are used for recording and playback.

of a second).

Since the tape is moving, after the first head has completed one track the second head records another track immediately behind the first. If head A records during the first 1/60 second, head B records during the next 1/60 second. The recording continues in an A, B, A, etc. pattern as shown in Fig 5-b. During playback, the same sequence occurs—the heads trace the tracks recorded on tape and pick up the signal, producing an FM signal that corresponds to the recorded video signal.

Figure 6 shows the relationship between the video tracks and TV signals. Since there are two heads, 60 diagonal

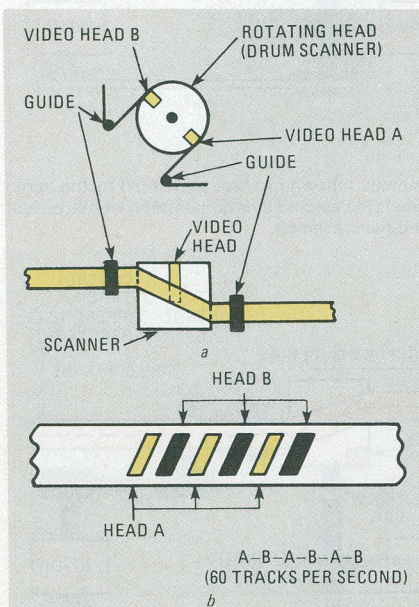


FIG 5—THE RELATIONSHIP between the video heads and the video tracks recorded on a tape.

tracks are recorded every second as shown in Fig. 6-a. One field of the TV video signal is recorded as one track on the tape, and two fields (adjacent tracks A and B) make up one frame as shown in Fig. 6-b. In both Beta and VHS, there is some overlap between the two tracks. For example, the video signal recorded by head A (just leaving the tape) is simultaneously applied to head B (just starting its track). During playback, this overlap is eliminated by electronic switching so that the output from the two heads appears as a continuous signal.

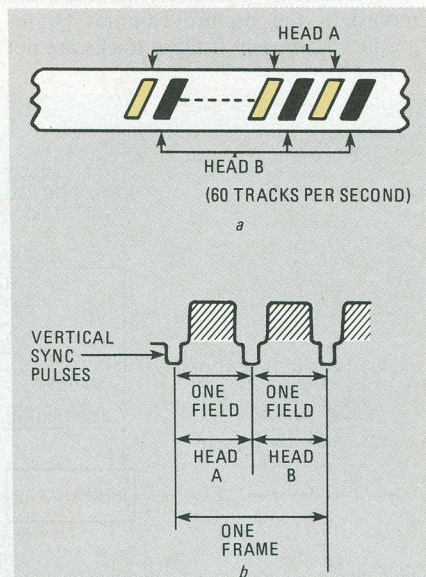


FIG 6—HOW FIELDS, frames, and tracks are related.

### Zero guard band recording

On studio-type VTR's, there is unrecorded vacant space between the video tracks. That blank area, or guard band, is necessary to eliminate crosstalk between tracks. Crosstalk occurs when the heads mistrack and play back a portion of two adjacent tracks. On consumer VCR's, there are no guard bands between the video tracks. Figure 7 shows a comparison of tapes with and without guard bands. Note that the tape without guard bands shown in Fig. 7-a (consumer VCR) contains much more information than the studio VTR tape shown in Fig. 7-b, and is often referred to as high-density recording tape. Although those high-density systems are called zero guard-band, there are guard bands that separate the audio and control tracks from the video tracks.

Without special precautions, crosstalk can occur in zero guard-band systems. In both Beta and VHS, the problem of crosstalk is eliminated by two techniques: azimuth recording and phase inversion.

### Azimuth recording

If you are familiar with audio-tape recorders, you know that considerable high-frequency loss (known as azimuth loss) occurs when there is a difference in the angle of the head (in relation to the tape) between record and playback. One symp-

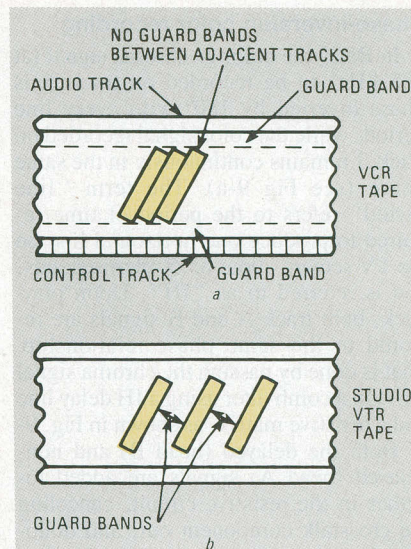


FIG 7—THE DIFFERENCES between home VCR tape and studio VTR tape. Note that in the VCR tape there is no guard band between the tracks.

tom of an audio recorder with any misalignment (known as azimuth error) is that the recorder plays back its own recordings without high-frequency signal loss, but produces considerable loss when playing back tapes made on other machines (where the tapes are recorded with different azimuth adjustments).

In VCR's, that azimuth-loss principle is used to eliminate high-frequency luminance crosstalk. The two video heads are mounted so that one head is at a different angle from the other head, as shown in Fig. 8. In Beta, the angle for one head (arbitrarily called head A) is  $+7^\circ$  from the reference point, whereas head B has an azimuth angle of  $-7^\circ$  from the reference, producing a difference of  $14^\circ$  between the heads. VHS uses a  $\pm 6^\circ$  azimuth difference (resulting in a  $12^\circ$  difference between head A and head B). During playback, a strong signal is picked up only when head A traces track A. If head A runs over to track B, for any reason, the track B high-frequency signal is weak and does not produce interference or crosstalk.

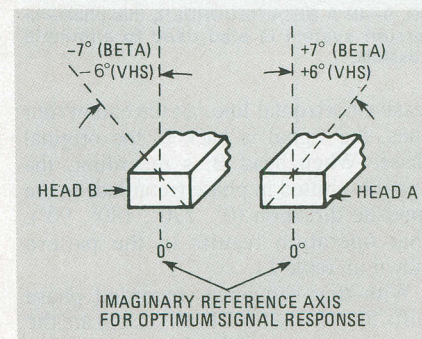


FIG 8—TO ELIMINATE high-frequency luminance crosstalk, the heads in a VCR are mounted so that they are at opposite angles to an imaginary reference axis.



## Phase-inversion color recording

In Beta, the color or chroma signal (at 688 kHz) to be recorded on track A is phase-inverted by 180° with every line period, while the color signal recorded on track B remains continuously in the same phase (see Fig 9-a). The term "line period" refers to the period of time required to produce one horizontal line on the TV screen, about 63.5 microseconds, and is referred to as "1H". Upon playback, both track A and B signals are restored to the same phase relationship. That is done by passing the chroma signal through a comb filter using a 1H delay line and a resistive matrix, as shown in Fig. 9-b. Both the delayed (head B) and non-delayed (head A) signals are added together in the resistive circuit, canceling the crosstalk component out, and doubling the normal color signal component amplitude.

The phase-inversion system used in VHS is entirely different from that in Beta. In VHS, the phase of the color signal being recorded on head A is advanced in phase in increments of 90° at each suc-

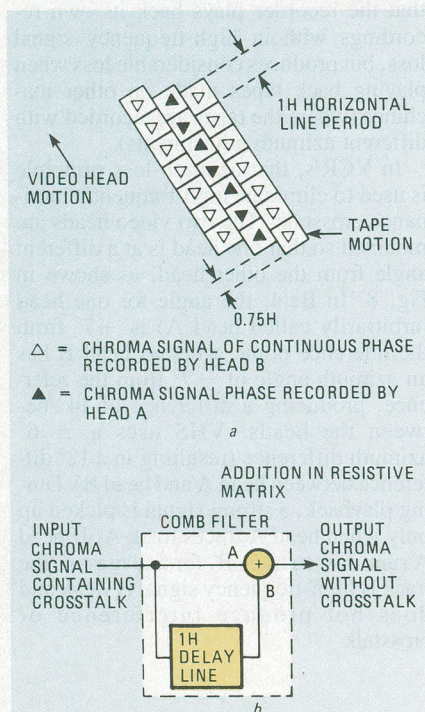


FIG. 9—IN A BETA RECORDER, this phase-inversion system is also used to eliminate crosstalk.

cessive horizontal line. At the end of four lines, the signal is back to the original phase. When head B is recording, the signal is shifted in phase (retarded) in the opposite direction (0°, 270°, 180°, 90°). That operation results in the pattern shown in Table 1.

With that sequence, recorded phase shifts for odd-number lines (1,3,5) are the same, but are opposite for even-number lines (2,4,6). Upon playback, the phase of the color signal is shifted on every other line and, when such a signal is passed

LINE	1	2	3	4	5	6
HEAD A	0°	90°	180°	270°	0°	90°
HEAD B	0°	270°	180°	90°	0°	270°

through a 1H delay line, the crosstalk component is canceled, and the normal color signal is doubled.

## Synchronizing the picture

No matter how precisely the tracks are recorded, the picture can not be reproduced properly if these tracks are not

movement. The heads are driven (by the same motor used to drive the tape capstan) so that the heads turn just a little faster than 1800 rps (30 Hz). The 60-Hz vertical sync pulses are applied to a 2:1 divider circuit, producing 30-Hz control signals (often referred to as the "CTL" signal). That CTL signal is recorded on tape by the separate stationary control track head (which is on the same stack as the audio head).

A pulse signal (called the "30 PG" signal) is generated by detecting the actual rotational speed of the heads. The most common way to generate the 30 PG signal

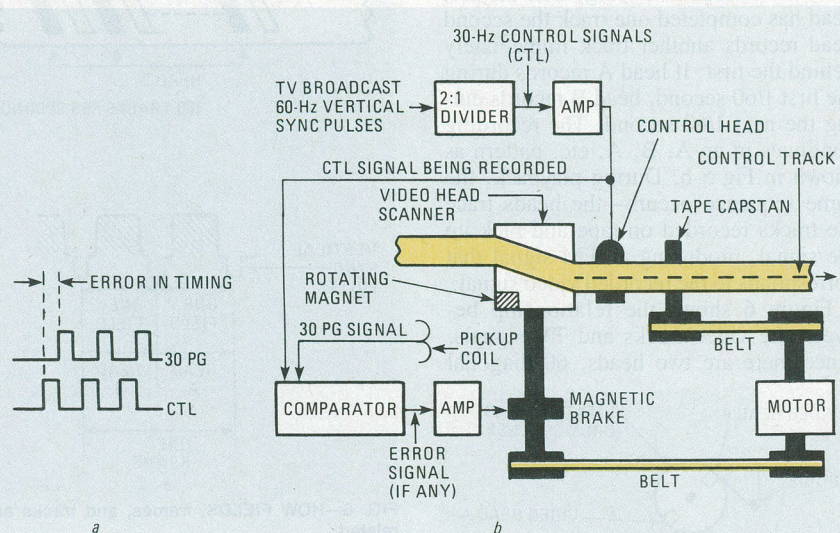


FIG. 10—DURING RECORDING, the CTL and 30 PG signals (shown in a) are generated by the servo system (shown in b). Any difference between those signals is detected by a comparator, whose output is amplified and used to control the speed of the video-head scanner.

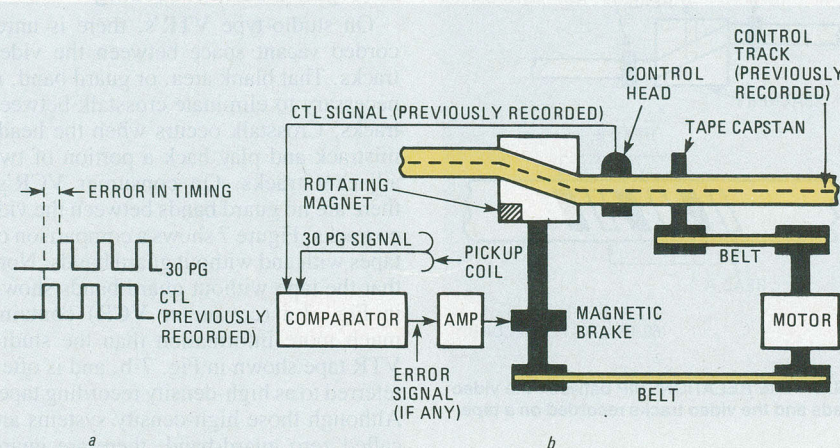


FIG. 11—THE OPERATION OF THE SERVO SYSTEM during playback is similar to that during recording. Here, however, the 30 PG signal is compared to a previously recorded CTL signal.

accurately traced by the rotating heads during playback. In addition to a high degree of mechanical precision, both Beta and VHS systems use an automatic self-governing arrangement, generally known as the servo system. Figures 10 and 11 show the operation of a typical VCR servo system during record and playback.

As shown in Fig. 10, the vertical-sync pulses of the TV broadcast are used to synchronize the rotating heads with tape

is to use a stationary pickup coil and a rotating magnet. The magnet is rotated together with the heads, and produces a pulse in the pickup coil each time the magnet passes the coil. The 30 PG signal is compared with the 30-Hz CTL signal, and any difference (or error signal) is amplified. The output of the amplifier is used to control the current of a magnetic brake that controls speed of the rotating heads.

*continued on page 102*



THERE ARE A LOT OF ADVANTAGES TO owning a videocassette recorder. One of the biggest, however, is the ability of a VCR, when used with a video camera, to capture on tape those cherished moments in everyone's lives. And, while not all of those moments occur in your home, with a portable video recorder the world can become your living room.

In this article, we are going to take a look at portable video equipment. Specifically, we are going to look at the most advanced systems, at least as far as portability goes, available in the two major formats—VHS and Beta. We are also going to take a look ahead at an exciting new development—8-mm video—that potentially could become the single universal standard of portable video equipment in the future. Needless to say, then, if the 8-mm standard comes to pass it will revolutionize home as well as portable video.

## VHS-C

JVC (41 Slater Drive, Elmwood Park, NJ 07407) has answered the public's call for more truly portable video with their VHS-C system. It consists of a compact,

lightweight recorder, the model *HR-C3U* (see Fig. 1), an ultra small camera, the model *GZ-S3U* (see Fig. 2), and a full line of accessories.

The key to what makes this system different, however, is their VHS-C cassette. That cassette is just one third the size of a standard VHS cassette and allows up to 20 minutes of recording time. That tiny cassette can, of course, be used to record and play back with the compact recorder. Because it is true VHS, it can also be used to record or play back on any standard VHS recorder, although a special adapter (model *C-PIU/C-P2U*) is required.

The major advantage to using the small-sized cassette is that it allowed JVC to manufacture the smallest, lightest, full-

capability VHS recorder currently on the market. The recorder measures just  $7\frac{1}{4} \times 3 \times 8\frac{1}{2}$  inches, and weighs only 5.3 pounds; both the measurement and the weight quoted here include the optional *NB-P3U* battery pack. According to JVC, it is 60% smaller than any other portable recorder that company has produced to date.

In addition to the nickel-cadmium battery pack, with the proper optional accessories the recorder can be powered from a car battery or, for home use, from any 117-volt AC source. Other features include automatic back-space editing for smooth edits, a running time display that shows how much time is left in minutes and seconds, a two-way speed-search mode, and a wired, full-function remote control.

The recorder lists for \$850.

Of course a small recorder deserves an equally small camera. JVC's *GZ-S3U* fits that bill nicely—it roughly measures just  $4 \times 4\frac{1}{2} \times 8$  inches and weighs 2.75 pounds. The camera uses a  $\frac{1}{2}$ -inch Saticon pick-up tube and an *f*/1.2 lens that allows recording at light levels as low as 30 lux (2.8 foot-candles). The lens system

## WHAT'S NEW IN PORTABLE VIDEO

CARL LARON  
ASSOCIATE EDITOR

*Here's a look at the state-of-the-art in portable video, as well as a look at the new 8-mm standard that could revolutionize the entire video industry.*







FIG. 1—THE SMALLEST VHS recorder yet, the HR-C3U from JVC uses the new VHS-C cassette.



FIG. 2—THE MODEL GZ-S3U compact camera.

also has a  $\times 6$  power zoom. A macro setting that allows for close focusing is also included.

As you would expect, the camera uses an electronic viewfinder. In-the-viewfinder displays include: pause, tape run, under-exposure warning, low-battery warning, tape-end warning, and sensitivity, white balance, and filter settings. As it is mounted on a flexible adapter, the viewfinder can be easily positioned however the operator wishes.

The camera lists for \$895.

One of the more interesting accessories for the system is the model SF-P3U frame. That frame allows the recorder and the camera to be combined into a single unit for on-the-shoulder operation (see Fig. 3). To make operation even simpler, the frame relocates the recorder's major controls so that they can be accessed easily when using the camera.

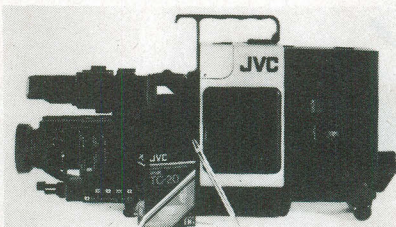


FIG. 3—PUTTING IT ALL TOGETHER. The HR-C3U and the GZ-S3U can be combined into a single unit for on-the-shoulder operation using the SF-P3U frame.

## Betamovie

Camcorders, one-piece video recorder/camera combinations, have been promised now for a couple of years. Well, by the time you read this, the first of those units should have reached your store's shelves. That unit, the *Betamovie* (model BMC-110) from Sony (Sony Drive, Park Ridge, NJ 07656) is a record-only camera/recorder combination that uses standard Beta cassettes. Because of that, the cassettes can, of course, be played back on any standard Beta deck.

According to Sony, the unit's small size was achieved thanks to major changes in the head drum and tape-loading system, as well as the decision to eliminate playback and TV-recording capabilities.

Let's look at the differences between a standard Beta deck and the *Betamovie*. Figure 4 shows the head drum and Fig. 5 the loading system in a standard Beta deck. As those figures show, all such decks use a 74.5-mm drum, two or more

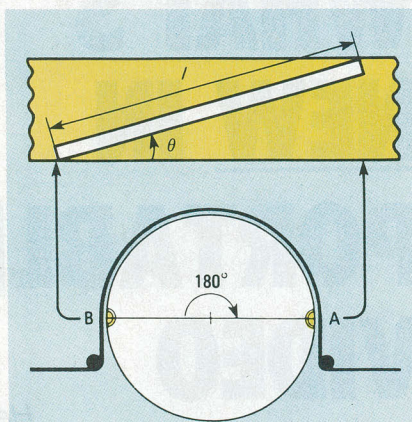


FIG. 4—IN THE STANDARD Beta system, a 74.5-mm head drum and two or more recording heads (located at A and B) are used.

heads, and a "U"-wrap loading system. Contrast that with the system used in the *Betamovie* as shown in Fig. 6 and 7. That system uses a 44.7-mm head drum, just one double-azimuth head, and a special  $\mu$ -wrap loading system. Those changes allow a small recorder mechanism while retaining full compatibility with the Beta system.

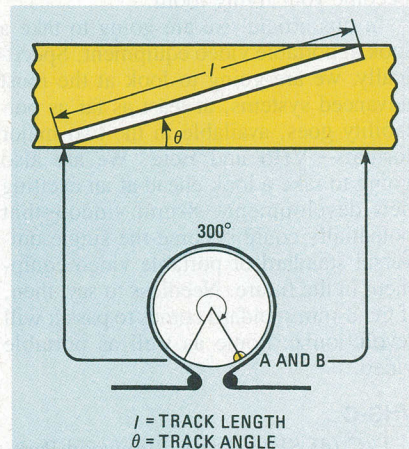


FIG. 6—THE SMALL SIZE of the *Betamovie* is partially made possible through the use of a smaller head drum, a single recording head (located at A AND B), and a special  $\mu$ -wrap loading system.

Turning briefly to some specifications, the *Betamovie* unit weighs just 7 pounds, including the battery pack and a cassette. It measures  $5 \times 8\frac{3}{4} \times 14$  inches, including all projecting parts. The unit operates at the Beta II speed (2-cm-per-second) allowing up to 3 hours and 20 minutes of recording with an L-830 cassette. The rechargeable battery pack will allow up to 60 minutes of continuous operation on a single charge. The battery pack fits into

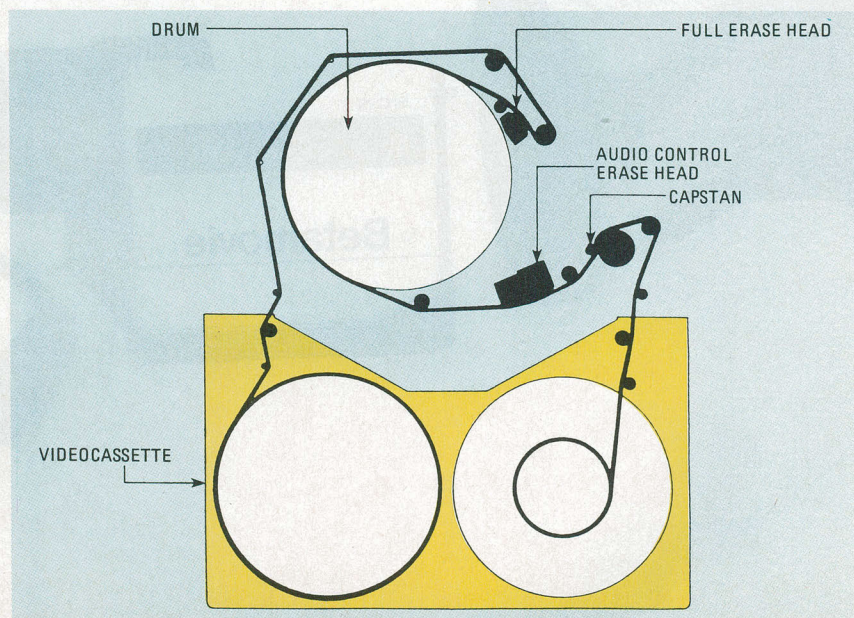
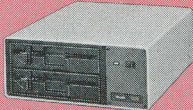


FIG. 5—THE U-WRAP LOADING SYSTEM used in a standard Beta deck.





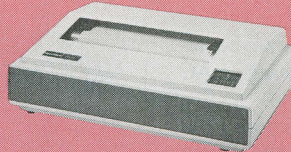
Courses in Computers and Programming



Disk Drives and Peripherals



All-In-One Computer



High-Speed Dot Matrix Printer



Superior Software Tools



Fully Portable Test Instruments



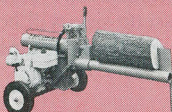
Hand-held Digital Multimeter



Programmable Automobile Horn



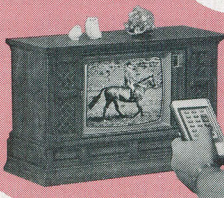
Telephone Accessories



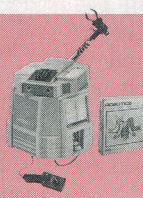
Hydraulic Log Splitter



Domestic Solar Water Heater



Space Phone Television



Hero I Robot and Course

# FREE Heathkit® CATALOG



**450 kits and products:** solar hot water systems, all-in-one 16-bit computers, test instruments, amateur radio gear, self-study courses in computer literacy and state-of-the-art electronics, energy conservation and home security devices, fine stereo components, color televisions, automotive or marine aids, home conveniences, robots and more — things you've always wanted and needed, right now at low kit prices from Heath.

**For people with imagination,** there's nothing to compare with the exclusive thrill of hand-built satisfaction.

**Discover the fun of kitbuilding** — it's a great way to relax in your spare time and share a rewarding pastime with your whole family. The great kits you build will reflect the pride of your craftsmanship, too. The famous Heathkit illustrated manuals make it easy for *anyone* to build reliable, professional-quality kits.

## SEND FOR FREE CATALOG

Our colorful catalog is Free! If coupon is missing write: Heath Company, Dept. 016-102, Benton Harbor, MI 49022.

**Heathkit®** Heath Company, Dept. 020-124  
Benton Harbor, MI 49022

Send me the latest free Heathkit Catalog now.  
I want to "build in" the quality difference.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

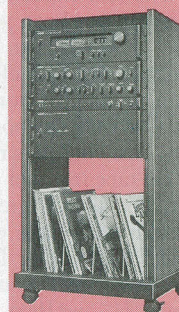
CL-764 Zip \_\_\_\_\_



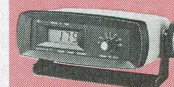
Trainers



Educational Self-Study Courses



Pro-Series Audio Components



Digital Marine Depth Sounder



Amateur Radio Gear



Computerized Weather Station

**FREE CATALOG**

DECEMBER 1983

73

Heathkit products are also displayed, sold and serviced at 65 Heathkit Electronic Centers\* nationwide. Consult telephone directory white pages for location.  
\*Operated by Veritechnology Electronics Corporation, a wholly-owned subsidiary of Zenith Radio Corporation.



the camera's hand grip and can be recharged in just about an hour using an AC adapter.

Looking at the camera section, the *Betamovie* uses a 1/2-inch Saticon pickup tube. The minimum light level required for satisfactory operation is 28 lux. The *f*/1.2 lens features a  $\times 6$  zoom and macro focus. The camera features a TTL (Through The Lens) optical viewfinder. LED's in the viewfinder are used to alert the operator to an insufficient light level, the white balance setting, the fact that the tape is running, and the fact that the record head requires cleaning.

The *Betamovie* is expected to sell for \$1500, and will be supplied with the battery pack and AC adapter.

### The new standard

The real excitement in portable video recently has been generated by the word out of Japan that agreement had been reached by 122 electronics companies from around the world on a new videotape standard for the home market. Using 8-mm tape, which is roughly half the width of the tape in either of the current popular formats, there's great hope that the new system will make even smaller portable systems possible. It's also believed that the new format could eventually replace both VHS and Beta. Therein lies the problem with the new system—many of its original proponents have since backed off, fearing that the new format could jeopardize the profitability of their existing video business. Others are promoting the development of a completely different standard than the one agreed upon, one that would allow compatibility with PAL, SECAM, and perhaps NTSC.

The new standard does not represent the first time that a narrow-width tape format has been explored. Indeed, most of us remember Funai Electric of Japan's CVC (Compact Video Cassette) system, the most recent of such efforts. Introduced here by Technicolor, that 1/4-inch system never gained popular support, and last year Technicolor announced that it was pulling out of the consumer-video market. Two other proponents of the system—Germany's Grundig and Japan's Elbex—also shelved their plans to market CVC recorders in this country.

### Specifications

The specifications covered in the agreement covered audio recording, tracking, cassette and tape, luminance signal, and the use of color-under conversion for NTSC and PAL video-signal recording. Let's take a closer look at them.

Like VHS and Beta, the new system uses a dual-head azimuth recording system. Such a system lays the video and audio information on the tape at an angle. The video-recording system itself, however, is the source of some controversy. In the agreed-upon standard, FM will

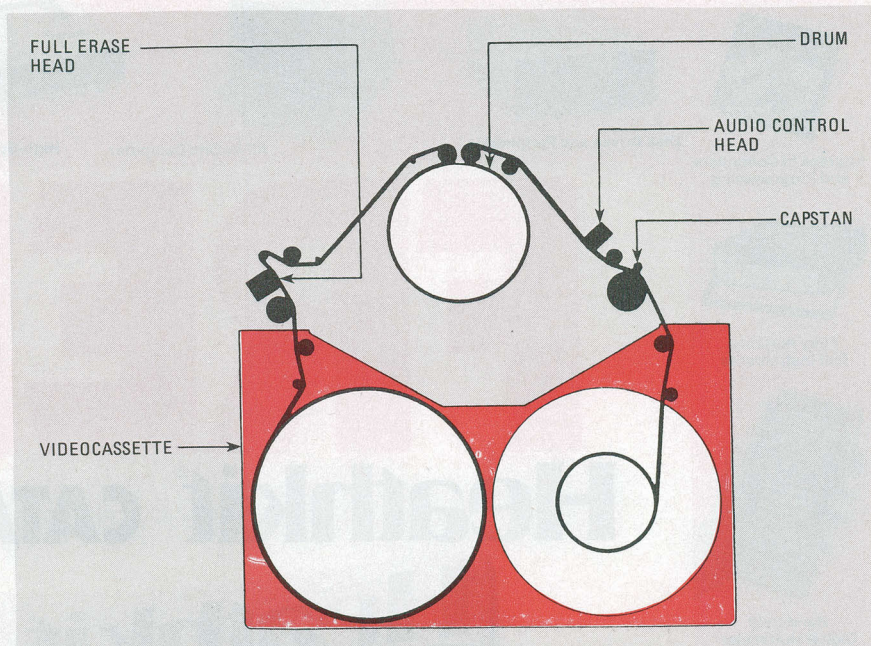


FIG. 7—THE SPECIAL  $\mu$ -wrap loading system used in the *Betamovie* recorder.

be used to record the luminance signal, while converted-carrier-signal direct recording (*color-under* or *down conversion*) will be used for the color signal. In color-under conversion, the 3.58-MHz chrominance subcarrier, which contains the color information, is down converted to a lower frequency (629 kHz for VHS, 688 kHz for Beta) that can be handled more easily by the recording system. But, while that system is fine for NTSC and PAL recordings, it is incompatible with SECAM. As for SECAM, France's Thomson-Brandt has proposed a baseband recording system that they call "Timeplex." That system, which would be compatible with SECAM, PAL, and NTSC, was proposed only shortly before the agreement was reached, and thus is still under study.

Turning to the audio specifications, the standard calls for one mandatory and two optional recording methods. The mandatory system is one-channel, high-fidelity FM. The audio signal is laid down using one of the rotary video heads, with the audio signal multiplexed with the video signal. Some type of noise reduction, though not completely specified by the standard, is required.

The first of the two optional audio systems is PCM (Pulse Code Modulation). The standard calls for two channels for that digital-audio system. Like FM, PCM audio is laid down using one of the rotary video heads. Unlike FM, however, no multiplexing is used; instead, the audio is placed on an auxiliary video track. Once again, some type of noise reduction is required.

The second optional audio system is simply called "Aux. Audio." Unlike the other systems, it is laid down on a 0.6-mm band at the bottom edge of the tape using a

completely separate, stationary audio head. Its use is apparently left open as little beyond its existence is specified. There is no mandatory noise reduction for that system.

Let's touch just briefly on some of the other points of the standard. The head drum is specified as 40 mm. Recording time is to be 1.5 hours for NTSC and 1 hour for PAL. Recording speed is 14.3 mm-per-second for NTSC; 20 mm-per-second for PAL. Compatibility with both metal-powdered and metal-evaporated tape is required. The cassette size will be 95  $\times$  62.5  $\times$  15 mm. The width of the tape is, of course, 8 mm.

### The cassette

The cassette for the system is designed to be as uncomplicated as possible, and thus inexpensive to produce. One thing that will go a long way to keeping production costs low is the elimination of tape guides. In their place, the cassette is to have a wide mouth that will accommodate as wide a variety of loading mechanisms as possible. There are also to be recognition holes that will allow the recorder to detect such things as the kind of tape and its thickness.

User convenience also seems to have been carefully considered. That is evidenced by such things as the inclusion of grips for use by an automatic tape changer, and the requirement of some type of restorable accidental-erasure prevention mechanism.

### Clouds on the horizon

Despite the trumpeting that accompanied that agreement this past March, the future of 8-mm video now appears less sure. Although the manufacturers wanted to present a common front and introduce

*continued on page 110*



# BUILD THIS

## Typewriter to

## Computer Interface



BILL GREEN

*Build this interface/buffer and use your IBM typewriter as a low-cost letter-quality computer printer. The 30K buffer can be used with the typewriter or any parallel printer.*

THERE ARE MANY TYPES OF PRINTERS that you can use to obtain hard-copy output from your computer. You can pay about \$400 for a dot-matrix printer with marginal print-quality or you can pay more than \$2000 for a daisywheel (or other type) letter-quality printer.

But there's a less expensive way to get letter-quality hard-copy output. You can build the interface that we'll describe here and convert your IBM *Selectric* (models II or III) or *Electronic* (models 50, 60, or 75) into a printer. The interface may work with models other than those just mentioned. But the installation is sure to require some changes to what we'll describe here.

A buffer option that we'll describe lets your computer rapidly dump more than 30,000 characters into RAM. Then you're free to use the computer, even while the document is printing. While that's especially important when using a relatively slow printer, such as a converted typewriter, the buffer can also be used with any parallel printer—we'll show you how. Another advantage of the buffer is that once a document is contained in its memory, you can print as many copies of it as you want—independent of the computer—simply by pressing the PRINT button.

What are the advantages of using the IBM typewriters? Well, the first advantage is low price and the second is high quality. When a used, reconditioned *Selectric*—which can be purchased for around \$400—is combined with this interface, you have a complete, letter-

quality printing system with readily changeable type fonts for not much more than the cost of a cheap dot-matrix printer. And you also still have a typewriter—the interface does not affect normal typewriter operation.

### The interface circuit

The schematic of the interface appears in Fig. 1. As shown there, it is configured for operation with a *Selectric*. That's because we think the most popular application will be converting that typewriter. Shown in Figs. 2, 3, and 4 are the options available: Figure 2 shows the changes that have to be made to the interface so that it can be used with *Electronic* typewriter, and Fig. 3 shows the changes that have to be made to use the interface with a parallel printer. Figure 4 shows how to add up to a 30K printer buffer. We'll look closer at those options in just a little while. Let's first look at the circuit in general.

The "heart" of the interface is a Signetics 2650 microprocessor, IC1. That microprocessor, under control of the program ROM (IC2), determines how much, if any, buffer memory is installed and what type of printing device is being used. It controls all I/O data transfers and timing, and memory data transfers. It also handles all code conversions when a typewriter is connected. (Those are necessary to convert the ASCII from your computer into a code that the IBM typewriters can understand.)

On power up, or whenever S2 is closed, the microprocessor is reset by a short

pulse that is provided from the combination of R2, C4, and hex-inverter IC3. After it is reset, the microprocessor begins execution of the program in IC2. The three-state output port (IC6) is set to its high-impedance mode and the latch output of IC7, pin 7—which tells the *Selectric* that the shift key is pressed—is cleared. Also the FLAG output (of IC1), which sends the *Selectric* an any-key-pressed signal, is cleared. A test is then performed to determine if RAM is installed and, if so, how much.

If no RAM is found, the computer performs a test to determine what type of printing device is being used. If the *Electronic* is connected, the level on SENSE will be high. If it is low and it remains low when FLAG is set, a *Selectric* is connected. If SENSE goes high with FLAG, diode D5 is installed, and a printer is therefore connected. After that test, the microprocessor runs the routine for the selected printing device and outputs the data from the external computer byte by byte.

However, if the memory test indicates that RAM is installed, the microprocessor initializes the buffer pointer and proceeds to store each byte from the external computer until the buffer is full or until all the data has been dumped. Then the routine to determine what printing device is being used is run as described earlier.

The driver routines for the *Selectric* and the *Electronic* typewriters are similar. In both routines the ASCII data from the external computer has to be converted to a



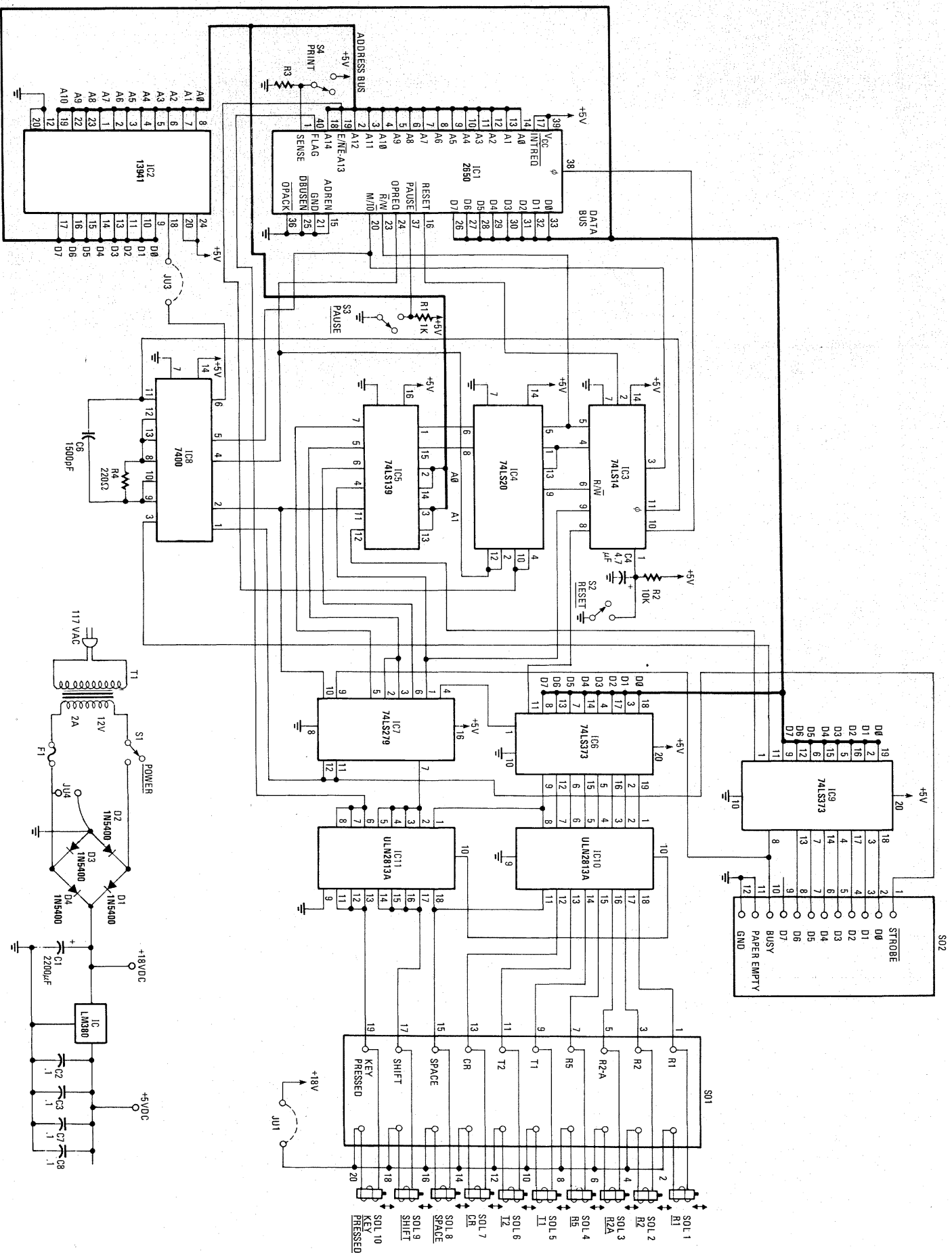


FIG. 1—THE SCHEMATIC FOR the interface is shown here configured for use with a *Selectric*.



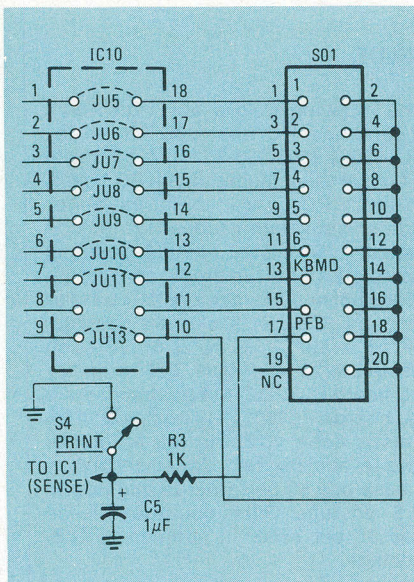


FIG. 2—THE CHANGES THAT ARE MADE to use the interface with the *Electronic* typewriter include removing IC11 and replacing IC10 with appropriate jumpers as shown here.

code that the typewriter can understand—that's done using an internal lookup table—and then outputting the proper code to the typewriter.

When using a *Selectric*, the interface determines all delays that are needed to allow for the typewriter's print cycles, space cycles, carriage-return cycles, and shift cycles. Those delay routines are dependent on the frequency of a clock that is made up of R4, C6, and two of the 2-input NAND gates in IC7. (That free-running multivibrator gives us a system clock with an oscillation frequency of about 1.24 MHz.) On the other hand, all timing for the *Electronic* is done by the typewriter itself and is signaled by the *PFB* (Print FeedBack) line.

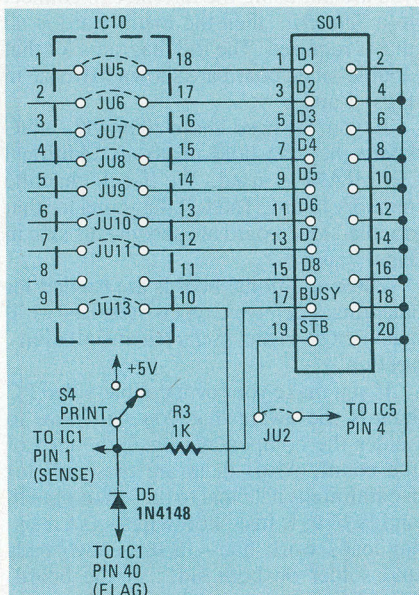


FIG. 3—THE CHANGES THAT ARE MADE to use the interface with a parallel printer also include removing IC11 and jumpering the pads for IC10.

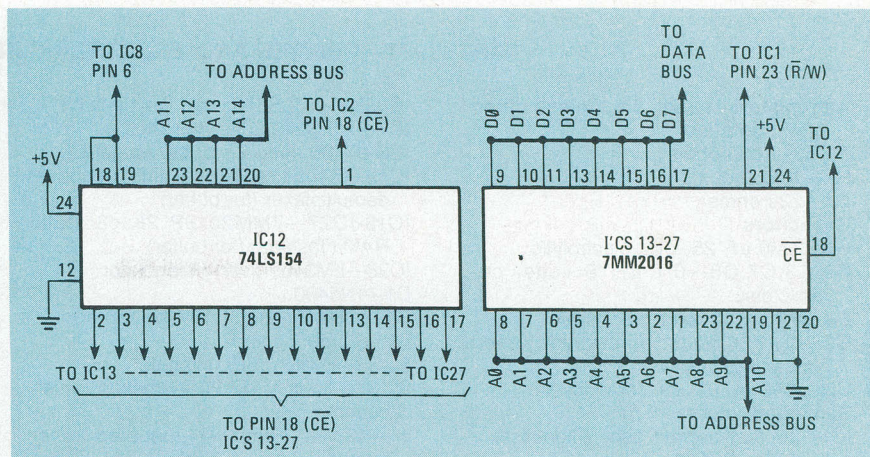


FIG. 4—BY ADDING IC12 and from one to fifteen TMM2016 static RAM'S, up to 30K bytes of buffer memory can be added to the interface.

When a printer is used with the interface, the enable signal for IC6 is connected to the printer's STROBE line and the interface reads the BUSY signal from the printer, allowing for synchronous operation. The ASCII code from the computer is stored in memory and is output unconverted—there is no need for conversion to a different code. Only the lower seven bits of the ASCII word are read however, so the printer will not respond properly to any special commands that use the eighth bit set.

Looking closer at the circuit, we see that IC4, a 74LS20 dual four-input NAND gate, controls IC5, a 74LS139 dual two-to-four line decoder. That IC in turn provides the enable signals for the 74LS373 8-bit three-state data latches (IC6 and IC9, which can be considered to be output and input ports respectively). Also, IC5 provides the set and clear pulses for IC7, a quad R-S latch.

We've already seen how two of IC8's NAND gates are used in a system clock. A third gate provides the chip-enable pulse for IC2 (the program ROM) when no RAM is used, or the enable pulse for IC12 (a four-of-sixteen decoder) when RAM is used. The fourth gate in IC8 provides the output-control signal for IC9 (the input port).

### Different configurations

Although we have already discussed some of the various ways that the interface can be configured, we'll look at them in a bit more detail.

When a *Selectric* typewriter is to be driven, as shown in the schematic of Fig. 1, two ULN2813A (or 2803A) octal high-current Darlington transistor arrays (IC10 and IC11) must be installed. Those high-current drivers, manufactured by Sprague, are needed to interface between the low-level digital logic circuitry and the ten solenoids that we'll be adding to control various latches in the *Selectric*. The drivers will sink 600 mA, but they can be paralleled if higher load-current capability is needed.

When the interface is used with the *Electronic* typewriter, IC10 is replaced with 8 jumpers (as shown in Fig. 2) and IC11 is not used. Of course the solenoids are not used, either. Thus the output of IC6 is connected directly across the 7 reed switches on the *Electronic*'s keyboard-switch plate, and the appropriate signal lines are brought to ground. But we're getting ahead of ourselves—all that will be covered in the "*Electronic* Installation" section.

The interface does not use its system clock for print timing when it's used with the *Electronic*, as it does when it's used with the *Selectric*. Instead, the interface reads the state of the *PFB* (Print FeedBack) reed switch for timing. That switch is debounced by R3 and C5.

When a standard printer is used, nine jumpers are used to replace IC10 and, again, IC11 and the solenoids are not used. The eight outputs of IC6 and the inverted enable pulse for that latch are connected to the printer as shown in Fig. 3. Note that S4 is wired differently here, also.

The system clock of the interface is not used for timing here, either. Operation is synchronous and the BUSY signal from the printer is used for timing.

The final configuration we'll discuss is the addition of a printer buffer. Of course, if you're going to be using a printer, it's not much of an option—the interface is not of much use with a standard printer if buffer memory is not added. But whether you're going to use a converted typewriter or a standard printer, the size of the buffer can be anywhere from zero to 30K. That is shown in Fig. 4. By installing IC12 along with from one to fifteen RAM's (IC's 12–27), you can determine the size of the buffer. You can start, say, with an 8K buffer, and then increase it to a full 30K when the need arises.

### Assembly

It is strongly recommended that you use PC boards for this project. If you do not need more than 8K of memory, and if



## PARTS LIST—PRINTER AND ELECTRONIC INTERFACE

**All resistors** ¼-watt, 5%, unless otherwise specified

R1,R3—1000 ohms

R2—10,000 ohms

R4—220 ohms

### Capacitors

C1—2200 µF, 25 volts, electrolytic

C2,C3,C7,C8—0.1 µF, 6 volts, ceramic disc

C4—4.7 µF, 10 volts, electrolytic

C5—1 µF, 6 volts, electrolytic (used only with *Electronic*)

C6—1500 pF, 6 volts, ceramic disc

### Semiconductors

IC1—2650 microprocessor, (Signetics)

IC2—13941 PROM, (Alpha)

IC3—74LS14 hex inverter

IC4—74LS20 dual 4-input NAND gate

IC5—74LS139 dual 2-to-4 line decoder/multiplexer

IC6,IC9—74LS373 octal D-type latch

IC7—74LS279 quad S-R latch

IC8—7400 quad 2-input NAND gate

IC12—74LS154 4-to-16 line decoder/demultiplexer (for buffer)

IC13-IC27—7MM2016P 2K × 8 static RAM (Toshiba) (for buffer)

IC28—LM340T five-volt regulator

D1—1N5400

D5—1N4148 (used only with printer)

F1—5-amp fuse

S1,S3—Switch, SPDT toggle

S2,S4—Switch, SPST, momentary push button

T1—12-volt 2-amp wall-mounted transformer

**Miscellaneous:** PC boards, fuse clip, IC sockets, 20-pin header for SO1, 5-watt heat sink for IC28, suitable case, wire, connectors and cables for your computer and printer

The following are available from Alpha Electronics, PO Box 1005, Merritt Is., FL. 32952 (305-453-3534). A complete kit of parts—including main PC board, memory PC board, cable, case—for printer conversion (does not include memory IC's): \$129 plus \$6 postage; complete kit for *Electronic* conversion (does not include memory PC board or memory IC's): \$119 plus \$6 postage; 2K × 8 static RAM IC's, \$6.50 each postpaid; 13941 PROM, \$25; memory PC board (PC1832) \$13 postpaid; main PC board, (PC1831), \$18 postpaid; ABS plastic case, \$12. Florida residents please add 5% tax. Canadian orders please add \$2 per order in addition to U.S. postage. Other countries please add \$6 per order in addition to U.S. postage.

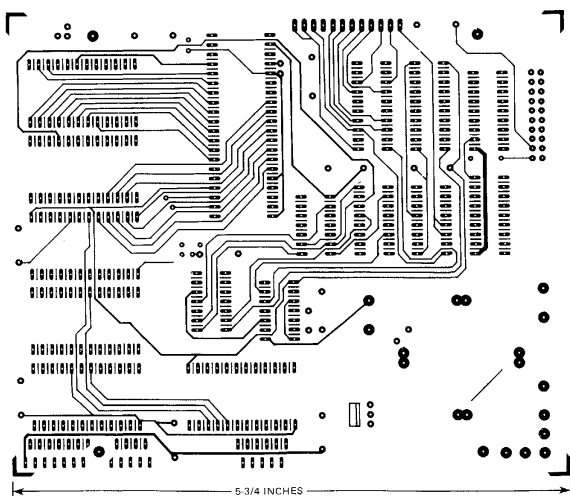


FIG. 5—THE FOIL PATTERN of the component side of the main board is shown here half-size

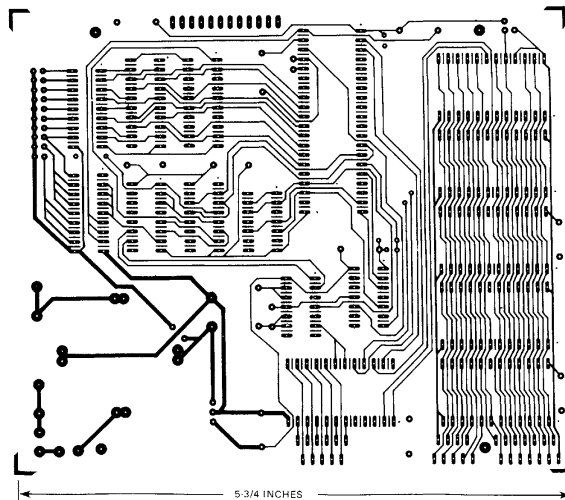


FIG. 6—THE FOIL PATTERN for the reverse side of the main board shown here half size.

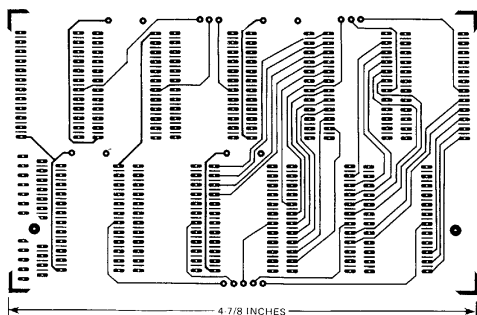


FIG. 7—THE FOIL PATTERN for the component side of the memory board is shown here half size.

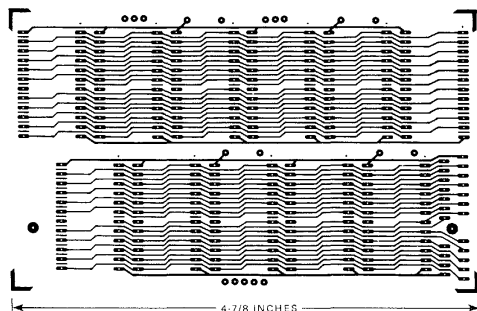


FIG. 8—THE FOIL PATTERN for the reverse side of the memory board is shown here half size.

you are not using the interface to connect to a *Selectric*, then the main board is all that is required. The foil diagrams for that double-sided board are shown half-size in Figs. 5 and 6.

If you do need more than 8K, a PC board that can hold up to an additional 22K RAM is used. We'll call that the memory board. The foil diagrams for that double-sided board are shown half-size in Figs. 7 and 8.

Three additional boards are needed for adapting a *Selectric* typewriter. But we'll get to those in the "*Selectric* Installation" section.

If you make your own double-sided PC boards, be aware that you will have to solder the components on *both* sides of the board. Also, there are two pads for feedthroughs near and to the left of pins 18 and 19 of IC1. Inst short wires—cut resistor leads work fine—in those two pads and solder on both sides of the board. (The PC boards available from the supplier named in the parts list have plated-

*continued on page 94*



```
0 perish
1 persist
```

REVIEW+ Version 1.2, Copyright 1981 - Oasis Systems

Add word to:	Other options:
U>date Dictionary	P>revious word
S>pec. Dict. "SPECIALS.CMP"	N>ext word
M>ark word	R>esume review
D>iscard word	L>ook up word
C>orrect word	V>iew context

```
--> PERSISH Corrected to -> PERISH_
```



*Spelling and style checkers are making it harder to make a mistake—but not when buying your program. Here we'll look at some features that you should be familiar with.*

# Spell Checkers

HERB FRIEDMAN

WORD PROCESSING HAS NOT ONLY MADE THE PREPARATION OF documents easier, it has made documents longer. Words and phrases are polished to perfection and, before one knows it, a short memo has turned into several thousand words.

According to Murphy's Law, however, the more words you type, the greater the chance for error: A greater percentage of words are misspelled; a greater percentage have typographical errors (typos); a greater number of words will be repeated, and phrasing becomes trite, repetitive, and riddled with cliches.

While you could muck your way through a word-processor-prepared document to correct spelling errors, typos, and style (phrasing and punctuation), a far easier way to polish a document is with an electronic spelling checker—which is sometimes improperly called an electronic dictionary—and/or one of the punctuation-and-style processors.

The electronic spelling checker is an independent program that processes a partial or completed document for spelling errors. All spelling checkers work on more or less the same basic premise; they compare the words in your document against a previously prepared list of correctly-spelled words (a dictionary). That list can either be complete unto itself, or it can be expanded, upgraded, or "enhanced" by the user. If there is no match for a word in your document with those in the dictionary the word is flagged. The flag means the word does not exist in the dictionary. The reason a word doesn't exist in the dictionary is because either the word is simply not listed (even though it is spelled correctly) or the correct spelling is in the dictionary but the spelling of the word in the document is incorrect. A modern spelling checker with 99% to 100% accuracy requires a precise match between the word in the document and those in its dictionary. If the match isn't found, it flags the word. (Many early spelling checkers used space-compression techniques that did not require a precise match. Hence, their accuracy ranged between 80% and 100%).

The number of words in the dictionary is determined primari-

ly by the disk system. It's approximately 25,000 words for single density, 50,000 to 100,000 words for double-density. More than 100,000 words can be stored on 8-inch disk drives, but since most **Radio-Electronics** readers have 5¼-inch disk systems, comments will pertain only to software that fits on 5¼-inch disk systems.

The manner in which the program tells you a word is incorrect or unrecognized varies from program to program, though many start the analysis in more or less the same way. The earliest of the spelling checkers were based on the procedures used for many dedicated word processors. The spelling-checker program would read the document, compile a list of the individual words, and then check the word list against the words in its dictionary. The document words that did not match a dictionary entry were flagged. The list of flagged words was scrolled on the screen and the user could indicate whether the words was to be skipped (accepted as correct), or marked with some form of symbol indicating the spelling was to be corrected. At the end of the list the software recorded a disk file that was identical to the original document except that "incorrectly spelled" words were marked. The user could then run the marked file through the word processor, search for the marking symbol, and then correct the document. Finally, when all errors were corrected, the document was printed.

*Spellguard*—one of the earliest and most famous of the spelling checkers for personal computers—uses the marking method. With *Spellguard* (Sorcim Corp., 2310 Lundy Ave, San Jose, CA 95131), the marking is done by changing the last letter of the marked word to a marking character, for example, a left bracket. To correct the words, the user can either scroll through the entire document correcting each marked word as it appears, or the user could use the word processor's search function to locate the bracket marking the words, and then correct the marked words.

The major difficulty with a marking-type spelling checker is that while it quickly locates the misspelled words, the actual



process of making the corrections can take up a lot of time.

Among the earliest spelling checkers for microcomputers that didn't use the marking system was *Hexspell* (from Hexagon Systems, Box 397, Station A, Vancouver, B.C., Canada V6C 2N2) for the Radio Shack *Model I* and *Model III* computers. *Hexspell* scrolls the document at a moderate reading speed so the viewer can see the entire document as it is checked for spelling. When it locates an unmatched word the scroll stops, the word is highlighted and the user can either accept the spelling, correct the spelling, or store the word in the dictionary at the touch of a single key. Regardless what decision is made, the scroll resumes. In this way the user sees each word in context, and gets a chance to spot other mistakes—such as duplicated words—that had gone unnoticed on the final read-through. When *Hexspell* has finished reading the document it asks if you want any dictionary words deleted (in case you had inadvertently keyed in an incorrect spelling). It then records the corrected version of the document in place of the old disk file, and then records a second corrected version under a file name you had selected when first starting *Hexspell*.

An unusual feature of *Hexspell* is that it learns your vocabulary—both the words you add to the dictionary and those you use most frequently. They “float” to the top of the list so they are checked more rapidly than words used infrequently.

Typical of much so-called “improved” software, the new “improved” version of *Hexspell* is not as convenient in certain important respects as the older version. The new version does not permit a phrase (two or more words) to be substituted for a single “misspelled” word. Also, the new version does not run under *Model III* TRSDOS (for reasons having nothing to do with *Hexspell*); it runs under NEWDOS, DOSPLUS and LDOS.

Radio Shack's own spelling checker for the *Model I* and *Model III* computers works very similar to the type that compiles a word list, checks all the unique words, and then displays the unmatched word in context. It provides a fully corrected version of the document. It is, however, considerably slower than the average “word compiler” spelling checker.

### The heavyweights

For those who have no need to scroll the document, the heavyweights in spelling correction are best represented by *The Random House ProofReader* by Aspen Software (Box 339-B, Tijeras, NM 87095), and *The Word Plus*, by Oasis Systems (2765 Reynard Way, San Diego, CA 92103). Both are similar in concept, but with substantially different applications. Both, however, represent the most efficient way to correct spelling errors on non-Radio Shack computers. Both programs determine all the unusual words in a document and then compile a list of unmatched words. While it is doing the compilation it keeps the user entertained with a screen full of almost useless information. The number of words checked is flashed on the screen, the number of unusual words is flashed, the *ProofReader* even does a countdown on the alphabet. All this stuff is fluff to entertain the user until the program is ready. Once the software has determined the unmatched words, it displays them on the screen one at a time. The user can then accept the word, correct it, add it to the dictionary system for permanent reference, or accept it as a “correct” reference only for the document being processed. (The *ProofReader* has that feature).

The software immediately updates the document by replacing the misspelled words with the correct spelling. *The Word Plus* and the *ProofReader* will even provide marking in addition to actual spelling correction if the correction will change the width of the word; which is important, for *WordStar*, because it does not automatically reformat.

It is in the correction process that these two correction systems really shine. First, in both systems the user can call for a viewing that displays the word in context—a line or so of text which includes the unmatched word is printed on the screen. Also, the user can call for a dictionary search (a lookup) if he or she doesn't know the actual spelling of the word. The *ProofReader* will fill the screen with words which generally approximate the

spelling of the unmatched word. The correct spelling can be selected from the display and typed in. *The Word Plus* does it somewhat differently. It displays fewer words, those more closely approximating the unmatched word. Adjacent to each word is a number or symbol. If any of the displayed words is wanted as a substitute for the unmatched word, simply pressing the key that corresponds to the symbol will enter it in the document.

At the conclusion of the processing both programs record a fully corrected disk file in place of the original document. If used with a CP/M computer, the original document, with all its errors, automatically becomes the backup disk file.

From here on out the two programs differ markedly, particularly in price. The *ProofReader* is about \$50, *The Word Plus* is \$150. The *ProofReader* constructs an auxiliary dictionary of words assembled as an ASCII file with a word processor, or keyed in during the processing of a document. The auxiliary dictionary must be added to the main dictionary periodically for the auxiliary words to be available during a lookup. If it isn't, the auxiliary words are used only for the start-up span.

*The Word Plus* is actually a system of several programs; the spelling checker is only one part of the system. It has a main dictionary and an update dictionary, but words keyed in during updating become part of the start-up dictionary system. *The Word Plus* also allows the user to construct specialized dictionaries, such as for law, medicine, or science. At start up, the user can call specifically for the use of the specialized dictionary(ies).

All of *The Word Plus'* routines can be called up as separate programs, such as when working on a document, or even while doing a crossword puzzle. The dictionary itself is accessed through a program called “SPELL.” Then there's one for automatic hyphenation that can even be used on-line. There's “LOOKUP,” which can also be used on-line to look up the correct spelling of a word, there's an anagram program used for unscrambling “jumble” puzzles, and a “homonym helper” that will untangle soundalike words such as “capital” and “capitol.”

Other spelling checkers, dictionaries, or whatever they are called, are more or less similar to the ones we have covered. As a general rule of thumb, you have no idea how they will work for you until you try them. There are some users who rave over the marking system used by *Spellguard*. Others prefer the screen full of words displayed by the *ProofReader*. Some, such as I, prefer the slow-scroll spelling checker, so defects other than misspellings can be found. Still others think the keyed lookup and instantaneous word replacement of *The Word Plus* to be the ultimate in spelling correcting. Your best bet—as with any purchase for a microcomputer—is to try a few before you buy.

### Grammar checkers

Finally, we come to punctuation and style, represented by *Grammatik* from Aspen Software, and *Punctuation & Style* from Oasis Systems. Both do the more or less the same thing. They check for proper punctuation, such as a period in front of the closing quotation mark rather than after, for clichéd, muddy and awkward phrasing, for duplicate words, etc. *Grammatik* will also check for sexist words (gender specific), and the number of times a particular word was used. It is really difficult to precisely describe what each does. *Punctuation & Style* is essentially into phrasing, *Grammatik* is into punctuation. Both tend to make copy bland, taking the individual writer out of the document. For example, they turn one of the classic lines of the Gettysburg address, “...that that nation...,” into just another phrase by just another politician. The processed documents are clear, but they could have been written by anyone.

But if you have no idea how to punctuate either for correct use or ease of reading, or you are submitting your prose to the *New York Times*, or you don't care if your stuff reads as if written by any of a thousand other authors, then let a computer check and correct your writing style. (Just imagine what a computer would do with this paragraph.)



# How to Design

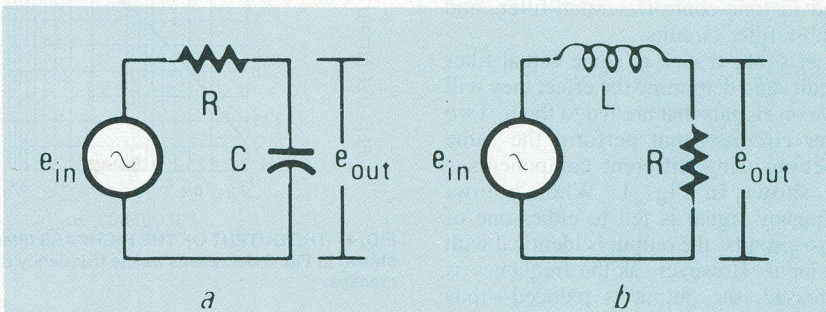


FIG. 1—TWO LOWPASS FILTERS. Even though the filters use different components, they perform in a similar fashion.

# Analog Filter Circuits

MANNIE HOROWITZ

*Because almost every analog circuit contains some filters, understanding how to work with them is important. Here we'll discuss the basics of both active and passive types.*

THE MAIN PURPOSE OF AN ANALOG FILTER circuit is to either pass or reject signals based on their frequency. There are many types of frequency-selective filter circuits; their action can usually be determined from their names. For example, a band-rejection filter will pass all frequencies except those in a specific band. Consider what happens if a parallel resonant circuit is connected in series with a signal source. It lets all frequencies pass freely, with the exception of those in a small band of frequencies around the circuit's *resonant frequency*. (At its resonant frequency, the parallel circuit theoretically acts as an infinite impedance. That impedance is greatly reduced at off-resonant frequencies.)

On the other hand, should the parallel L-C circuit be placed across (in parallel with) the signal source, only the narrow band previously rejected would be allowed to pass from the source to the amplifier. Thus, we have just described a *bandpass* filter.

In addition to bandpass and band-rejection filters, circuits can be designed to only pass frequencies that are either above or below a certain *cutoff* frequency. If the circuit passes only frequencies that are below the cutoff, the circuit is called a *lowpass* filter, while a circuit that passes those frequencies above the cutoff is a *highpass* filter.

All of the different filters fall into one of two categories: active or passive. *Passive* filters are composed of passive components such as resistors, capacitors, and inductors. Inductors, however, are undesirable at some frequencies because of their size and/or practical performance. (At low frequencies, a real inductor's properties vary considerably from those of an ideal inductor.) *Active* filters consist of passive elements along with an active element such as a transistor or an integrated-circuit op-amp. Active filters are usually designed without using inductors. Therefore they have the advantage of being less expensive on the aver-

age (because inductors can be expensive and hard to find); they are generally easier to tune; they can provide gain (and thus they do not necessarily have any insertion loss); they have a high input impedance, and have a low output impedance.

A filter can be in a circuit with active devices and still not be an active filter. For example, if a resonant circuit is connected in series with two active devices (such as transistors) it is called a passive filter. But, if the same resonant circuit is part of a feedback loop, it is then called an active filter. We saw an example of such an active filter when we discussed a tape-player preamplifier during our discussion of feedback (see the July 1983 issue of *Radio-Electronics*).

## Basic filters

A rudimentary passive filter consists of an R-C network or an R-L network. Those networks can be found in many different types of electronic equipment performing different roles. For example,



in power supplies, such circuits are used to filter undesirable ripple. In audio amplifiers, different R-C networks are used in tone-control, scratch-filter, and rumble-filter circuits.

Let's take a look at some actual filter circuits and determine the effect they will have on signals that are fed to them. Two filter circuits—that perform the same function using different components—are shown in Fig. 1. When a low-frequency signal is fed to either one of those circuits, the output is identical with the input. However, as the frequency is increased, the output is reduced—thus they are lowpass filters. The output rolls off at the rate shown by the curve in Fig. 2. The important frequency to note is  $f_o$ .

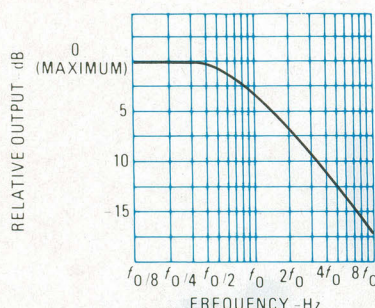


FIG. 2—THE OUTPUT OF THE LOWPASS filters shown in Fig. 1 decreases as the frequency increases.

That's the frequency where the output has dropped 3 dB from its maximum value (0.707 of the maximum). That *corner frequency* (also called the half-power point) can be determined from the values of the components in the circuit. For the R-C circuit in Fig. 1-a:

$$f_o = 1/2\pi RC. \quad (1)$$

For the R-L circuit in Fig. 1B:

$$f_o = R/2\pi L. \quad (2)$$

Figure 3 shows two circuits, either of which can be used to attenuate the *low* frequencies (thereby creating a highpass filter). Note that the curve shown in Fig. 4, when compared to Fig. 2, is symmetric about the y-axis. In Fig. 2, the output drops in the linear portion of the curve by 6-dB every time the frequency is doubled. In Fig. 4, the output drops by 6-dB every time the frequency is halved. The important point is that in the linear portion of

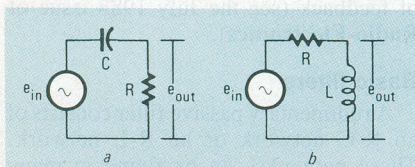


FIG. 3—TWO HIGHPASS FILTERS that use different components but perform similarly.

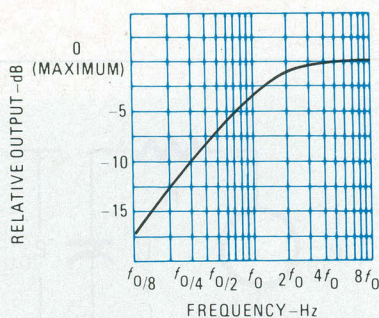


FIG. 4—THE OUTPUT OF THE HIGHPASS filters shown in Fig. 3 decreases as the frequency decreases.

each curve, the slope is the same—6-dB-per-octave.

Any of these filter circuits can be placed between two amplifier stages. If that's done, the corner frequency,  $f_o$ , is still as predicted by equation 1—presuming that the impedance of the circuit feeding the filter is zero and the input impedance of the circuit at the output of the filter is infinite. Otherwise, resistors in series with the input to the filter and in parallel with the output from the filter, must be considered when determining  $f_o$ .

For example, assume that the circuit in Fig. 3-a is connected between two transistors, as shown in Fig. 5-a. Figure 5-b is the equivalent circuit involving the filter and transistors. (The function of coupling capacitor C1 is to DC-isolate the transistor from the filter. That capacitor is usually of such magnitude that it can be treated as a short for all signal voltages.) It can be simplified by determining the equivalent resistance,  $R_o$ , of all resistances at the output. The final circuit is shown in Fig. 5-c. Equation 1 applies there also.

The analysis of this circuit—as well as more complex filter circuits that have more than one corner frequency—can be accomplished in two simple steps. First, short the input,  $e_{in}$ , and note the total resistance across the capacitor. In this

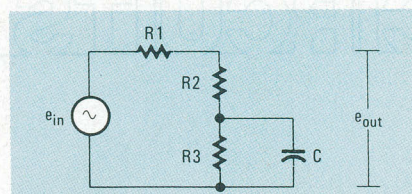


FIG. 6—A MORE COMPLEX filter circuit. This filter has more than one corner frequency.

case it is  $2.7K + R_o$ . Using equation 1, we determine that  $f_o = 1/2\pi(2.7K + R_o)C$ . The frequency at which the rolloff starts is  $f_o$ , as shown in Fig. 4.

The next step is to place a short across the output and leave  $e_{in}$  open. There is no parallel R-C combination in the circuit when that is done; the only frequency indicated in the response calculations of the filter is  $f_o$  and its curve in Fig. 4.

Now let's look at a more complex filter circuit—one in which there will be more than one corner frequency. We will use the procedure noted above to analyze the circuit in Fig. 6 and find those corner frequencies. One  $f_o$  corner frequency is the beginning of the rolloff characteristic curve and a second  $f_o$  corner frequency is on a curve with rising characteristics. The two resulting curves are then added to provide a curve illustrating the overall response of the circuit as shown in Fig. 7. First, we short  $e_{in}$  and note the total resistance across C— $R3$  in parallel with the sum of  $R1$  and  $R2$ . Substituting this information into equation 1, we find that one of the corner frequencies, where the high-frequency roll off starts, is:

$$f_{o1} = 1/2\pi ((R1 + R2) \parallel R3)C.$$

We continue by leaving  $e_{in}$  open and shorting  $e_{out}$ . Then,  $R2$  is across both  $R3$  and C. By inserting those values into equation 1 we find for the second corner frequency:

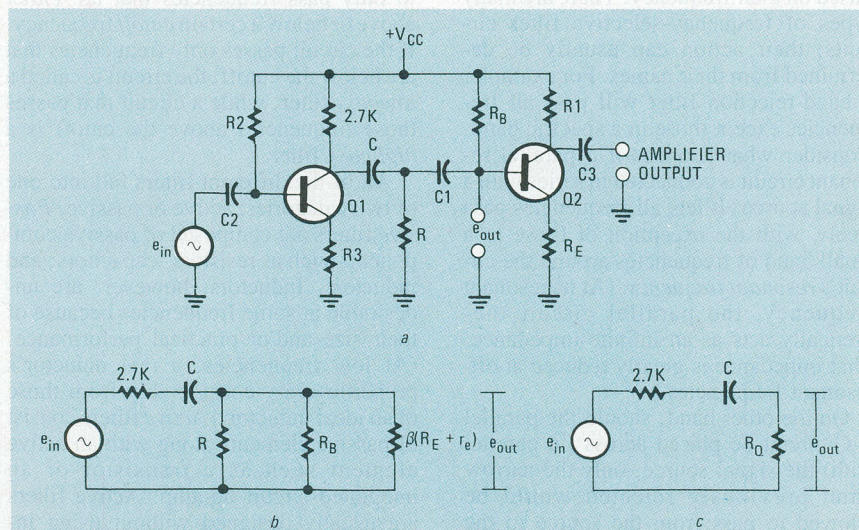


FIG. 5—TO WORK WITH a filter between two transistor circuits, you must first find the simplified equivalent circuit.



$$f_{o2} = 1/2\pi(R2 \parallel R3)C$$

The curves add as shown in Fig. 7. The total curve indicates the overall response of the filter. The two equations differ only by the resistance factors. Because  $R2 \parallel R3$  is smaller than  $(R1 + R2) \parallel R3$ ,  $f_{o2}$  is higher in frequency than is  $f_{o1}$ . A similar procedure may be used to determine the frequency response of other complex arrangements.

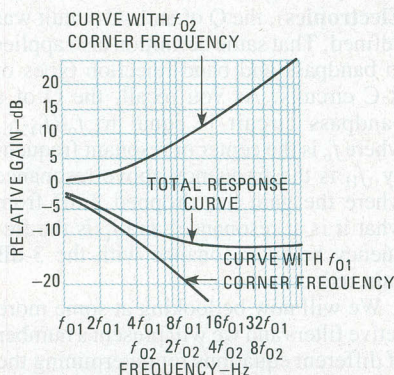


FIG. 7—FREQUENCY RESPONSE curve of the circuit shown in Fig. 6.

### Sharpening the rolloff

Rolloff using but one R-C or one R-L network, cannot exceed a 6 dB-per-octave rolloff rate. However, a faster rolloff rate can be achieved by using more than one filter in a circuit. An arrangement using two lowpass filters connected in series is in Fig. 8. There,  $R1-C1$  is one network with a corner frequency at  $f_{o1}$ .

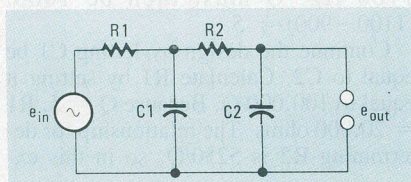


FIG. 8—TO INCREASE THE ROLLOFF RATE, you can use more than one filter in a circuit.

The combination of  $R2$  and  $C2$  is a second filter network, with a corner frequency at  $f_{o2}$ . Those corner frequencies are determined through use of equation 1 for each R-C combination. Curves with those corner frequencies are shown in Fig. 9. Each curve illustrates a rolloff at the rate of 6 dB-per-octave. Adding the two curves results in a characteristic with an eventual rolloff of 12 dB-per-octave.

If more resistors and capacitors are added to a circuit of the type shown in Fig. 8, a procedure similar to that used with the circuit in Fig. 6 may also be used. But this time, the circuit must be split into two portions with each containing the individual filter sections, and each section is analyzed as if the other section does not exist. The effects on the frequency response of each of

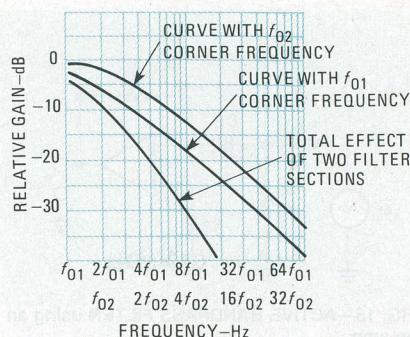


FIG. 9—THIS FREQUENCY-RESPONSE CURVE shows how the rolloff is sharpened by using more than one filter.

the two sections are then added to determine the circuit's overall response.

Other two-section filters (two R-C networks) can be combined to generate a bandpass filter circuit. That is illustrated in Fig. 10. There is low frequency rolloff due to the  $C1-R1$  section of the filter and high frequency rolloff due to the  $R2-C2$  filter. The corner

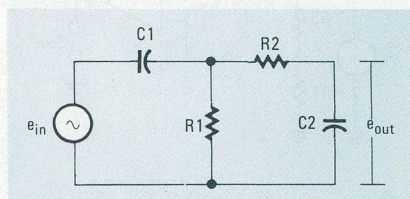


FIG. 10—BANDPASS FILTER USING two R-C networks.

frequencies,  $f_{o1}$  and  $f_{o2}$ , are determined for the  $R1-C1$  combination and the  $R2-C2$  combination, respectively. When  $f_{o1}$  is substantially less than  $f_{o2}$ , the response curve for the circuit is as shown in Fig. 11-a. Should  $f_{o1}$  be higher in frequency than  $f_{o2}$ , the curve in Fig. 11-b applies.

In the circuits drawn in Figs. 8 and 10, the  $R2-C2$  combinations probably have some effect on  $f_{o2}$ . (The responses of

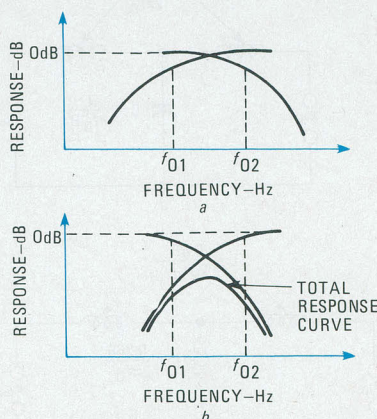


FIG. 11—FREQUENCY-RESPONSE CURVES. The response when  $f_{o1}$  is less than  $f_{o2}$  is shown in a. It is equal to that of the two original curves below the 0-dB level. Shown in b is the response when  $f_{o2}$  is less than  $f_{o1}$ .

those filters are shown in Figs. 9 and 11.) To minimize their interrelated effects, components should be chosen so that the  $R2-C2$  circuit has a minor shunting effect on  $R1$  and  $C1$  and that the  $R1-C1$  combination has only a minor affect on loading the  $R2-C2$  combination. It is best if the two circuits were completely isolated from each other by placing each R-C filter between different transistors in a three-transistor amplifier circuit.

### Active filters

An active filter involving bipolar transistors, is shown in Fig. 12. Here we assume that  $R_E$  is much greater than  $r_e$ , the internal emitter resistance of  $Q2$ . Capacitor  $C1$ , along with the output impedance of  $Q1$  and the input impedance of  $Q2$ , form one high pass filter. The corner frequency,  $f_{o1}$ , due to those components is

$$f_{o1} = 1/2\pi C1(R_c + \beta R_E \parallel R_B)$$

if we assume that the impedance of  $C2$  is much higher than  $R_F$  at  $f_o$  Hz. Here,  $R_c$  is the impedance at the input of the filter,  $\beta R_E$  is the impedance reflected from the emitter circuit of  $Q2$  into its base circuit, and  $\beta R_E \parallel R_B$ , the equivalent resistance of  $R_B$  in parallel with  $\beta R_E$ , is the resistance at the output of the filter. Due to those resistances, the output rolls off at frequencies below  $f_{o1}$ .

A second corner frequency,  $f_{o2}$ , is caused by the presence of  $C2$  and  $R_F$  in the emitter circuit. Because  $C2$  shunts a portion ( $R_F$ ) of the total resistance in the emitter circuit, feedback due to the presence of this resistor is reduced as the frequency increases. Hence beginning at  $f_{o2}$ , the output increases with the applied frequency. It is equal to  $1/2\pi C2 R_F$ .

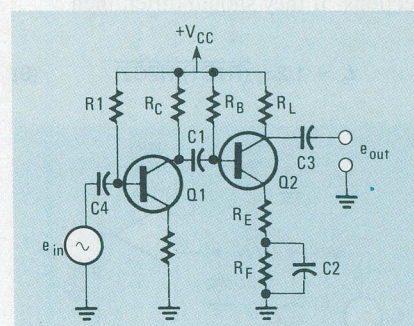


FIG. 12—ACTIVE TRANSISTOR FILTER has three corner frequencies.

Next consider the total resistance in the emitter circuit not shunted by  $C2$ . It is  $R_T = R_E + R_B/\beta$  where  $R_B/\beta$  is the resistance reflected from the base circuit into the emitter circuit. A corner frequency due to the action of those resistances along with the  $C2-R_F$  combination is  $f_{o3} = 1/2\pi C2(R_F R_T/(R_F + R_T))$ . Voltage begins to roll off at that frequency.

It is obvious that  $f_{o3}$  is at a higher frequency than is  $f_{o2}$  because the resistance



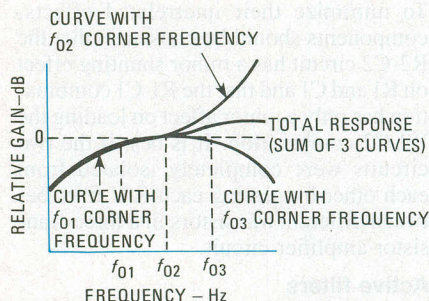


FIG. 13—CURVE SHOWING THE THREE corner frequencies and how they add to provide the overall circuit response.

in the denominator of the equation for  $f_{03}$  is lower than that for  $f_{02}$ . Usually,  $f_{01}$  is lower than either  $f_{02}$  or  $f_{03}$  because the capacitance of  $C_1$  and the input and output resistors in the circuit, are all large. The value of  $R_F$  is seldom negligible when considering the factors in equation for  $f_{01}$  because  $C_2$  can frequently be considered as an open circuit at  $f_{01}$  Hz.

Four curves are shown in Fig. 13. Three of these represent the response of individual filter sections in the circuit, with rolloff or amplitude increases starting at the three corner frequencies. The total curve shows the overall effect on the response of the combination of the three.

### Using op-amps

Now we'll look at an active filter that is designed around an op-amp. In the circuit shown in Fig. 14-a, the capacitor in the feedback loop attenuates the high frequencies, therefore, the circuit behaves as a lowpass filter. The frequency at which the output has been attenuated 3 dB can be approximated from equation 1 when  $R$  and  $C$  are identical in both filter sections. If they should differ, then

$$f_0 = 1/2\pi\sqrt{(R_1C_1)(R_2C_2)} \quad (3)$$

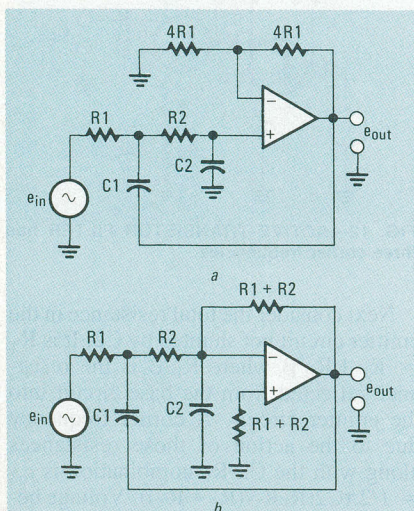


FIG. 14—ACTIVE LOWPASS FILTER. The signal is fed to the non-inverting op-amp input in *a*, and to the inverting input in *b*.

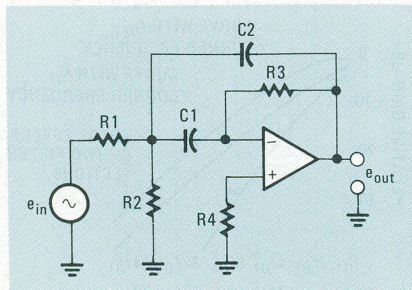


FIG. 15—ACTIVE BANDPASS FILTER using an op-amp.

where  $R_1$  and  $C_1$  are the components in one of the  $R$ - $C$  networks and  $R_2$  and  $C_2$  are the components in the second  $R$ - $C$  network. An inverting circuit could just as well have been used here. Figure 14-b shows such an arrangement. Equation 3 still applies. Negative feedback is applied

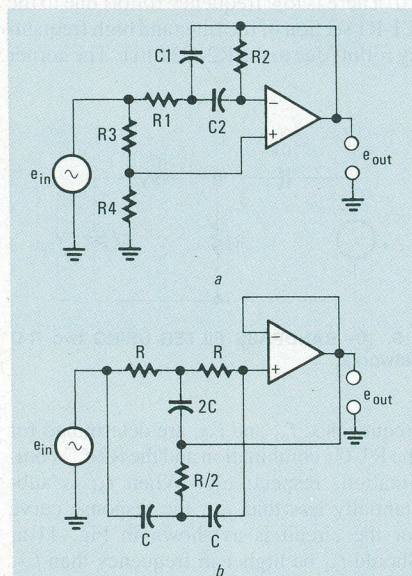


FIG. 16—ACTIVE BAND-REJECTION filters using op-amps. The filter shown in *b* uses a twin-T circuit.

through  $C_1$ —high frequencies are fed through  $C_1$  back to the input, to increase the rolloff rate. In both lowpass-filter circuits,  $R_1$  and  $R_2$  are usually made equal—about 10,000 ohms.

Highpass filters can be formed using circuits identical to those drawn in Fig. 14. All that's necessary is to interchange the locations of components in the  $R_1$ - $C_1$  filter as well as components in the  $R_2$ - $C_2$  filter. As before, equation 3 applies.

In the article on high frequency circuits (see the August 1983 issue of **Radio-Electronics**), the  $Q$  of an  $L$ - $C$  circuit was defined. That same definition also applies to bandpass and band-rejection types of  $R$ - $C$  circuits. As you recall, the  $Q$  of a bandpass circuit is equal to  $f_0/(f_H-f_L)$  where  $f_0$  is the center or resonant frequency,  $f_H$  is the frequency above resonance where the gain has dropped 3-dB from what it is at resonance, and  $f_L$  is the frequency below resonance with the 3-dB gain reduction.

We will now be looking at some more active filters and we will present a number of different equations for determining the various  $C$ 's and  $R$ 's that are needed. We will not derive the equations; the filters will be presented in "cookbook" form. You'll achieve good performance if the given relationships are observed. Rolloff will approach the ideals of 40 dB-per-octave for the circuits we'll discuss.

A typical bandpass filter circuit using resistors and capacitors is shown in Fig. 15. Before you determine what components you use, you must calculate just what  $Q$  must be. Let us say you want a peak response at 1000 Hz and that the gain should be down 3 dB at 900 Hz and 1100 Hz.  $Q$  must then be  $1000/(1100-900) = 5$ .

Continue the design by letting  $C_1$  be equal to  $C_2$ . Calculate  $R_1$  by setting it equal to  $100,000/Q$ . Because  $Q = 5$ ,  $R_1 = 20,000$  ohms. The relationship for determining  $R_2$  is  $5250/Q$ , so in this ex-

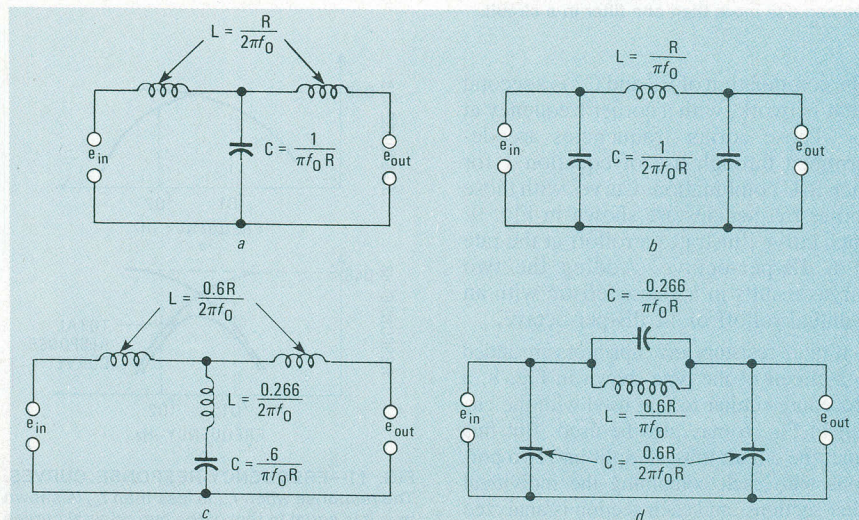


FIG. 17—LOWPASS FILTERS. The circuit shown in *a* is a constant-K T-section filter; *b* shows a constant-K  $\pi$ -section; *c* shows an M-derived T-section, and *d* shows an M-derived  $\pi$ -section filter.



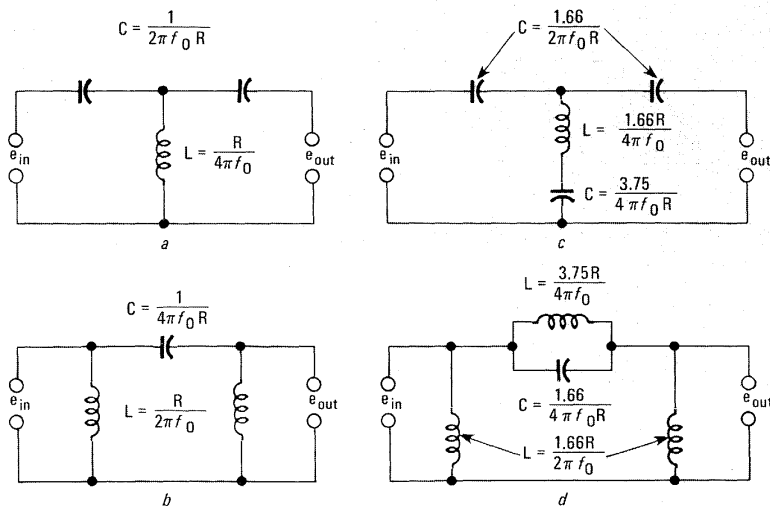


FIG. 18—HIGHPASS FILTERS. The circuit shown in *a* is a constant-K T-section filter; *b* shows a constant-K  $\pi$ -section; *c* shows an M-derived T-section, and *d* shows an M-derived  $\pi$ -section filter.

ample,  $R_2$  should be set equal to 1050 ohms. The value of  $R_3$  is equal to the product of 20,000 ohms and  $Q$ . For this problem,  $R_3 = 100,000$  ohms.

For the circuit in Fig. 15

$$f_o = 1/2\pi \sqrt{C_1 C_2 R_3 (R_1 \parallel R_2)} \quad (4)$$

Because  $C_1$  is identical to  $C_2$ , the product of the two capacitances is  $C^2$ . To determine  $C$ , equation 4 becomes

$$C = 1/2\pi f_o \sqrt{R_3(R_1 \parallel R_2)}. \quad (5)$$

Substituting  $f_o = 1000$ ,  $R_3 = 1000,000$ , and  $R_1 \parallel R_2 = 998$  into equation 5 yields the fact that  $C = 0.016 \mu\text{f}$ . If you follow the results, you can obtain a capable filtering circuit.

A band rejection or notch filter is in Fig. 16-a. Here,  $Q$  is determined as before. Capacitor  $C_1$  is usually made equal to  $C_2$  and the resonant frequency, as in-

indicated in equation 3, is:

$$f_o = 1/2\pi \sqrt{R_1 R_2 C_1 C_2}.$$

Once  $Q$  has been determined, the ratio of  $R_2$  to  $R_1$  in the circuit can be set equal to  $4Q^2$ . Make  $R_1$  equal to about  $100,000/Q$ ,  $R_3$  equal to about  $5250/Q$  and  $R_4$  equal to about  $50 \times R_3$ . Using this information, calculate the  $C$ 's for the circuit through use of equation 3.

Another type of notch filter (often called the twin-T arrangement) built around an op-amp is shown in Fig. 16-b. In that circuit,  $f_o$  can be determined using equation 1. Because  $Q$  can be very high, the rolloff is sharp.

### Constant-k and m-derived filters

Constant-k filters get their name from the fact that the product of the capacitive and inductance reactances ( $X_C \times X_L$ ) is constant at all frequencies. They exhibit reasonably sharp rolloff with a smooth passband. However, sharpness of rolloff can be improved considerably by using an m-derived filter.

An m-derived filter can be recognized by the parallel-resonant or series-resonant circuit in series or across the line respectively. They produce essentially infinite attenuation of the frequency to which they are tuned (thus zero transmission of that frequency along the line).

Schematics of both constant-k and m-derived filters are shown in Figs. 17 through 19.

Component values in the circuits depend on the resistance at the input to the filter circuit as well as the resistance at its output. In this discussion, we assume them to be equal—that is the usual case. We denote that resistance by the letter  $R$ . If input and output resistances differ, let  $R$  equal the average value of the resistance at the input and output. Rolloff will be affected by that mismatch. But resistance can be adjusted to the ideal by merely adding the proper transistor circuits at the input and output of the filter.

In the bandpass circuits, the  $Q$  of the coils do affect the sharpness of rolloff, but only to a minor degree. Rolloff at the low end of the pass band starts at  $f_L$  while rolloff at the high end of the passband starts at  $f_H$ . ( $f_L$  and  $f_H$  were defined above). For these circuits the resonant frequency is equal to  $\sqrt{f_H f_L}$ .

The various filter circuits shown include equations to indicate the approximate values of the components to be used in the circuits. Using those, you should be able to design a practical circuit.

Several constant-k or m-derived filter sections may be combined to sharpen rolloff and increase attenuation at different frequencies, if required. Input and output impedance matching will not be disturbed by such combinations.

Next time we'll look at another aspect of solid-state devices—how they can be used in switching applications. **R-E**

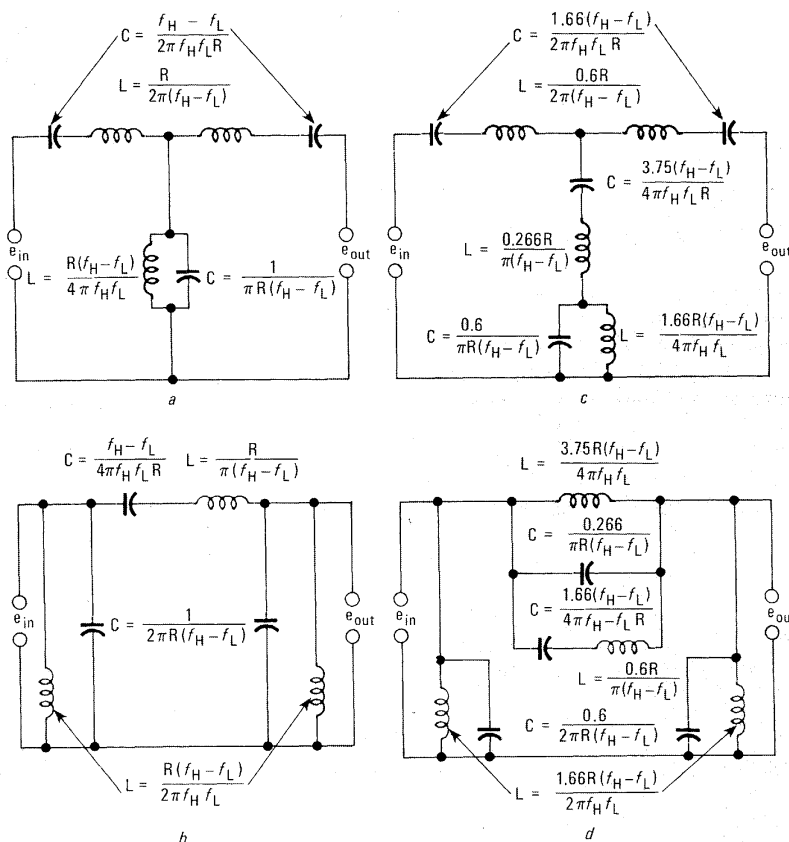


FIG. 19—BANDPASS FILTERS. The circuit shown in *a* is a constant-K T-section filter; *b* shows a constant-K  $\pi$ -section; *c* shows an M-derived T-section, and *d* shows an M-derived  $\pi$ -section filter.



# BUILD THIS



*Interference from AM (broadcast-band signals can often be a source of irritation for shortwave listeners and longwave enthusiasts. Here's one way to eliminate the offending signals.*

R.W. BURHANS

SHORTWAVE AND LONGWAVE RADIO listeners are often plagued with interference from strong, local, broadcast-band (BCB) stations. The interference often results in intermodulation distortion in the receiver. Antenna tuners or RF preselectors are often used to reduce the problem. Sometimes, traps made up of parallel-tuned L-C circuits are simply connected in series with the receiver's antenna-input cable. However, a more effective trap—one that we will discuss—is the T-notch circuit. The T-notch trap also consists of a parallel L-C circuit—but the capacitor has a center tap that is fed to ground through an adjustable resistor. Figure 1 shows a dual T-notch circuit that is used to attenuate interference from two local broadcast-band stations. (In our case, each station is located about one mile from the test sight.) Of course, a single T-notch trap can be used if you have a single-station interference problem.

The T-notch trap operates as a delay-and-add network. The tunable, parallel L-C circuit provides a  $180^\circ$  phase shift from input to output. The delayed signal is then added to the original (with a multiplying constant). The variable resistor—by letting you adjust the phase and how much of the original signal will be added to the delayed signal—provides a way to adjust the circuit for a sharp null.

## Circuit design

Let's consider a single T-notch trap. For a 50-ohm antenna system, the trap's inductor,  $L$ , is chosen such that its reactance ( $X_L$ ) is in the range of 30 to 100 ohms. At the band of frequencies we're interested in (600–1600 kHz), that requires an inductance in the range of  $7\ \mu\text{H}$  to  $12\ \mu\text{H}$  with a fairly large parallel capacitance. (Two capacitors, connected

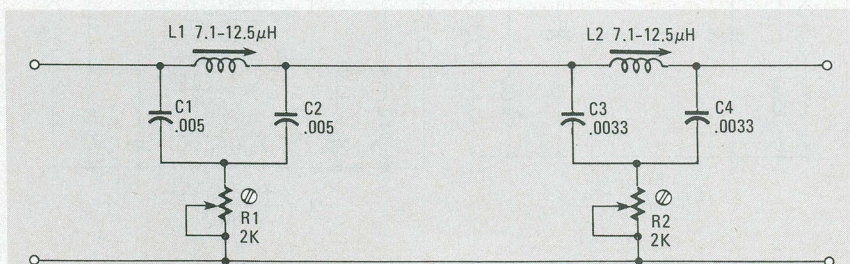


FIG. 1—T-NOTCH TRAP. Our trap was set to reduce interference at 970 kHz and 1340 kHz. Coils L1 and L2 were set to 10.5 and  $8.5\ \mu\text{H}$  respectively.



TABLE 1—Capacitor Selection

Capacitor value	Trap frequency for L = 12.5 $\mu$ H	Trap frequency for L = 7.1 $\mu$ H	Midband $X_L$
.01 $\mu$ F	625 kHz	810 kHz	40 $\Omega$
.0068 $\mu$ F	770 kHz	1000 kHz	50 $\Omega$
.005 $\mu$ F	860 kHz	1200 kHz	65 $\Omega$
.0033 $\mu$ F	1100 kHz	1480 kHz	72 $\Omega$
.0022 $\mu$ F	1360 kHz	1800 kHz	100 $\Omega$

## PARTS LIST

R1, R2—2000 ohms, trimmer potentiometer  
 C1–C4—polystyrene capacitors (values depend on the interfering frequencies—see text and Table 1)  
 L1, L2—7.1–12.5  $\mu$ H slug-tuned coil (Mouser 542-23A105RPC or equivalent)

in series, are required for each trap. Don't forget that the value of each will be double that required for an equivalent single-capacitor parallel L-C resonant circuit.) Table 1 shows a selection of capacitors designed to cover the AM band. (The capacitance values shown are for each capacitor—not the equivalent of the two capacitors in series.) The inductor is a 7.1-to-12.5  $\mu$ H slug-tuned, adjustable RF coil with a Q greater than fifty. We mentioned one possible source for that coil in the parts list. In addition, we have also used many surplus adjustable inductors on older-style ceramic forms with considerable success.

## Trap performance

While the trap will work best when driven from a 50-ohm source and terminated in a 50-ohm receiver load, it can also be used with 500-ohm receiver input-terminals. However, its null will not be as deep. Figure 2 is a graph that shows the typical response of a T-notch trap circuit when it is connected in series with a 50-ohm active antenna system that covers the range of 10 kHz to 30 MHz. (Such active antenna systems were discussed in the February through April 1983 issues of *Radio-Electronics*.) We should note that this trap circuit does not present any problems when it is used in series with active antenna systems where DC power flows in the connecting cable between an antenna preamplifier and receiver coupler. The reason that that is the case is because there is a direct, low-resistance DC path from input to output and no DC ground.

When used at frequencies above 3 MHz or below 500 kHz, this T-notch trap is very effective at removing interference from broadcast-band stations—as seen in

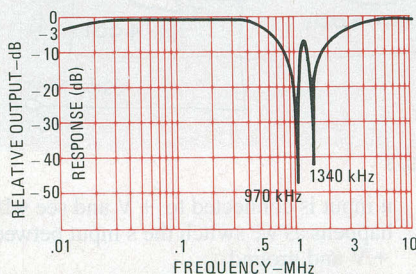


FIG. 2—THE RESPONSE of the trap in Fig. 1 is shown here. The local offending stations are WATH (970 kHz) and WOUB (1340 kHz). While the power of neither station is above 1 KW, they produced considerable interference.

Fig. 2, the trap's -3-dB skirts start at 500 kHz and extend to 3 MHz. In our test setting, we achieved nulls of at least -40 dB at the two selected local-interference frequencies. You should find it possible to tune the trap for an even deeper null of -60 dB—but that requires very careful adjustment of the inductor and adding-resistor. At the deepest null point there will be a pronounced 2nd-harmonic effect, but at a very low level. That effect (where you see a signal of twice the frequency of the interfering signal) is a result

that's particularly true when two traps are used (because of the interaction between the circuits.)

## Applications

The T-notch trap is not limited to reducing broadcast-band interference. We have used similar traps for Loran-C receiver input circuits to remove 88-kHz and 115-kHz signals that were causing interference in the desired 90–110 kHz Loran-C range. If you are designing a trap circuit that uses use similar inductor val-

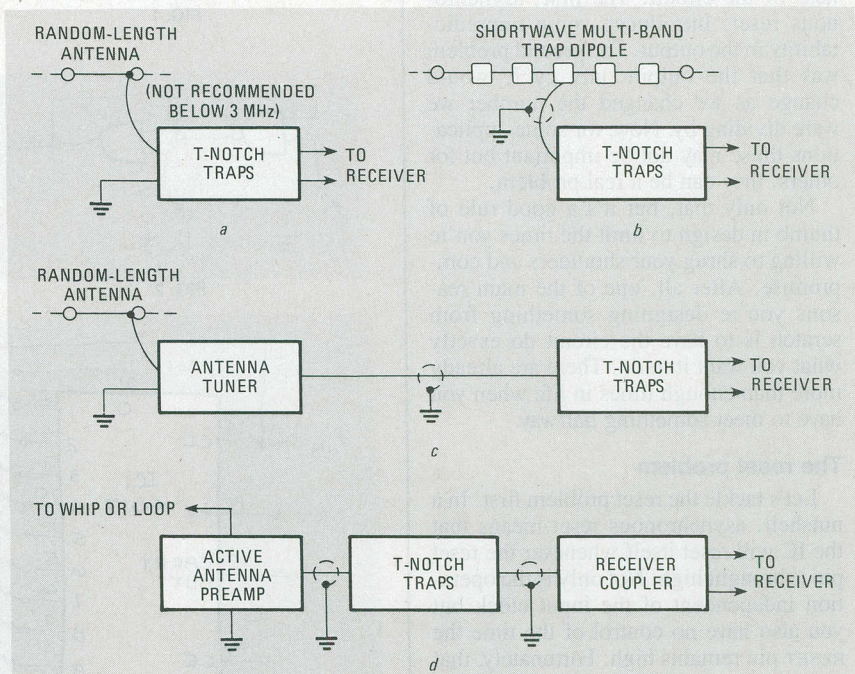


FIG. 3—THE T-NOTCH TRAPS can be used with various antennas.

of the addition of the delayed and original signal.

## Tuning the trap

To be of use, the trap has to be tuned to the particular offending stations in your area. The method of adjusting the traps is rather simple: First, tune your receiver to the interfering station. Next, adjust the inductor to reduce the signal and then adjust the resistor for a sharper null. We mentioned previously that the resistor is used to trim the circuit and obtain a sharp null point. That null is deepest when  $R = QX_L/4$  (where Q is the unloaded Q of the inductor). It is usually necessary to go back and forth over those adjustments—

ues for traps for two different frequencies, it is often best to place the lower-frequency trap first (toward the antenna) with the higher-frequency trap toward the receiver.

Figure 3 shows ways of using T-notch traps with various receiving antennas. If a short random wire is directly connected to the trap input at frequencies below about 3 MHz, the trap shunt capacitance will effectively short the antenna or act like a large attenuator. Thus, this low-impedance trap is most useful at a 50–500-ohm impedance level when inserted between a receiver and a tuned antenna, antenna tuner, or active-antenna system.



# THE DRAWING BOARD

## Solving the reset problem

ROBERT GROSSBLATT

THE MOST IMPORTANT THING WE LEARNED from last month's discussion of counters in general and the 4017 in particular is this: you get what you pay for. Using the 4017 to get nice cheap frequency division was like a lot of things in life—it seemed like a good idea at the time but when we put the IC to work we only got half of what we expected. The circuit was certainly cheap enough but the results were a far cry from nice. Two major problems showed up that really limited the usefulness of the circuit. The first, asynchronous reset, introduced some unpredictability in the output. The second problem was that the output duty cycle would change as we changed the number we were dividing by. Now, for some applications those may not be important but for others, they can be a real problem.

Not only that, but it's a good rule of thumb in design to limit the times you're willing to shrug your shoulders and compromise. After all, one of the main reasons you're designing something from scratch is to have the circuit do exactly what you want it to do. There are already more than enough times in life when you have to meet something halfway.

## The reset problem

Let's tackle the reset problem first. In a nutshell, asynchronous reset means that the IC will reset itself whenever the reset pin is brought high. Not only is the operation independent of the input clock but you also have no control of the time the RESET pin remains high. Fortunately, that problem can be licked with a little bit of imaginative gating.

The trick to adding synchronous reset to the 4017 is being able to control the RESET pin. We need some sort of gating arrangement that will make it go high when we want; and more important, make it go low when we want. We also need some way of making sure that latter signal comes when RESET is completed. Remember that the 4017 is disabled as long as the RESET pin is held high.

Let's digress for a bit. What we're talking about here is a gating arrangement that has two independent inputs and whose output will change state when triggers are applied to each of the inputs. So, as you've probably guessed by now, we need a flip-flop. Now, you can use some standard-type flip-flop such as the 4043 or

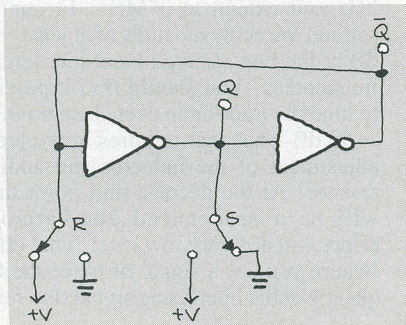


FIG. 1

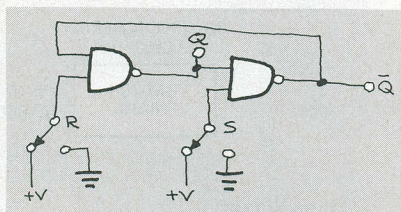


FIG. 2

R	S	Q	$\bar{Q}$
LOW	LOW	No Change	
LOW	HIGH	HIGH	LOW
HIGH	LOW	LOW	HIGH
HIGH	HIGH	Not Allowed*	

\*See text

put will be positive and the  $\bar{q}$  output will be negative. In fact, triggering either of the outputs will produce entirely predictable results and obviously stable outputs. The only thing we can't do is connect both the  $r$  and  $s$  inputs to the same polarity—if we did, the whole thing would obviously go up in smoke. Since we all know that if something bad can happen it *will* happen, we'd better look further for our needed flip-flop.

In Fig. 2, we've done the same sort of thing with a pair of NAND gates. The operation of the circuit is more interesting and, ultimately, more useful. Let's assume the

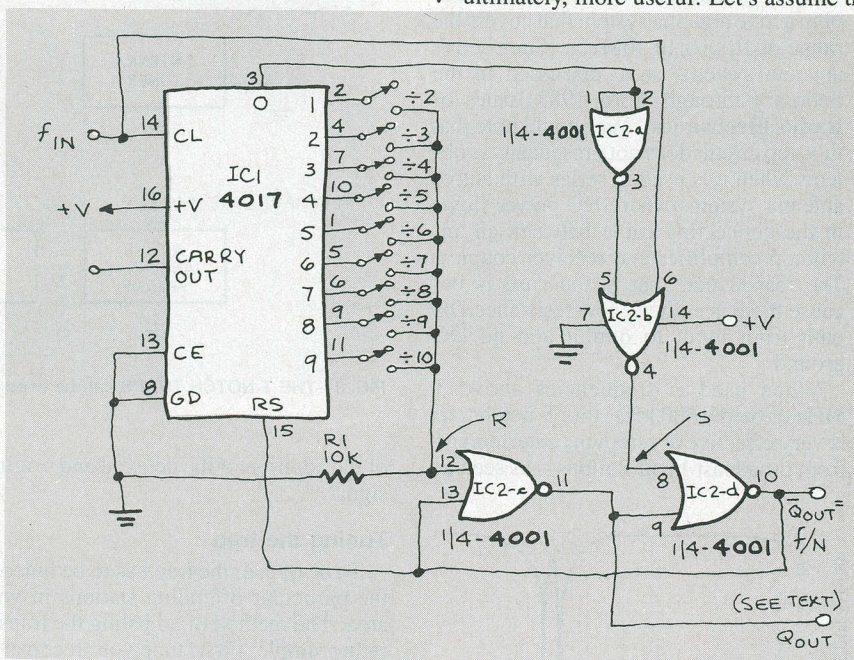


FIG. 3

4044; but in line with the established traditions of this column, let's see what we can do with a bunch of simple gates.

Figure 1 shows how we could build a simple flip-flop. It's made from two inverters and is mechanically triggered. If we connect the R switch to ground the o out-

R input is connected to +V and see what happens as we switch the s input between +V and ground.

If we connect the s input to ground, the  $\bar{Q}$  output will be high because a NAND gate has a high output if one or more of its

*continued on page 93*

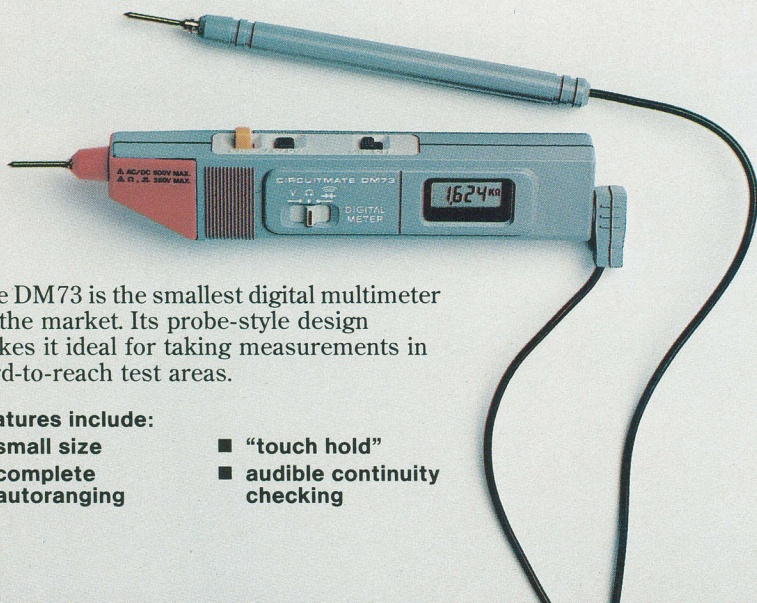


# Beckman introduces two additions to its Circuitmate Family.



# asked for at prices demanded.

**\$72.95**  
(U.S. only)



The DM73 is the smallest digital multimeter on the market. Its probe-style design makes it ideal for taking measurements in hard-to-reach test areas.

**Features include:**

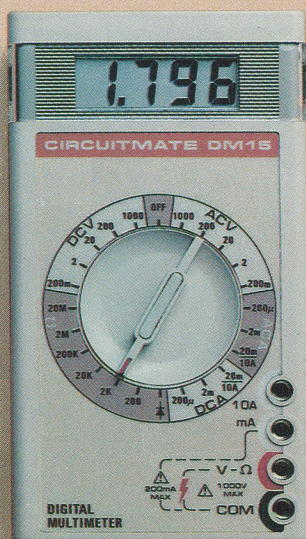
- small size
- complete autoranging
- "touch hold"
- audible continuity checking

**\$64.95**  
(U.S. only)

When you need to make transistor gain checks, the DM20 is your best bet. This HFE meter is small in size, but big in features.

**Features include:**

- transistor gain tester
- dual voltage resistance test function
- conductance measurement capability
- 10 amps



**\$59.95**  
(U.S. only)

For just \$59.95, the pocket-sized DM15 offers you all the basics with 0.8% basic Vdc accuracy.

**Features include:**

- separate diode test function
- 10 amps
- 24 ranges

Beckman now offers you two more feature-packed Circuitmate™ DMMs for less than \$100. The DM73 and the DM77. Both meters offer you complete autoranging, plus the same high performance you can expect from all Circuitmate™ DMMs.

## Feature Packed

The Beckman Circuitmate™ DMMs offer you a broad range of popular features. The line begins with an extremely low-cost, basic meter and spans up to a full-featured DMM with capacitance.

You can select such features as: dual voltage resistance ranges, conductance, autoranging, in-circuit resistance testing, audible continuity testing, and transistor gain checking.

## Easy to Use

All Circuitmate™ DMMs are designed for maximum convenience and ease of use. The rotary dial makes selection simple and sure, while the bright display makes reading easy.

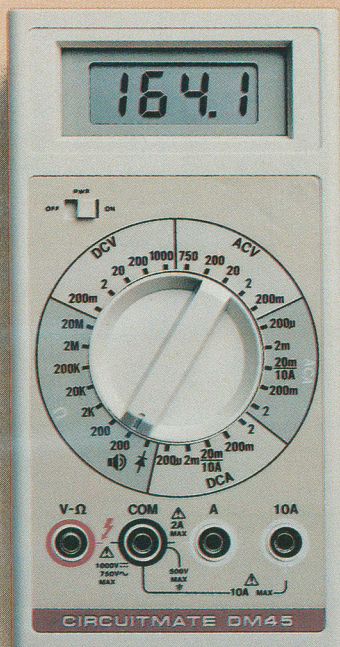
Special convenience features found only on certain models include: tilt bale, autoranging, "touch hold", easy-access battery hatch, and anti-skid pads.

# BECKMAN

CIRCLE 10 ON FREE INFORMATION CARD



# Features you've a you've de



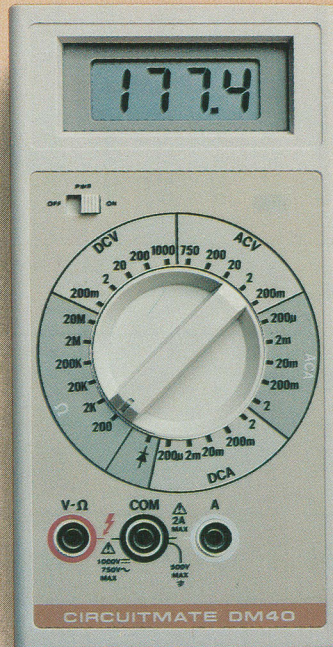
**\$89.95**

(U.S. only)

The DM45 is a full-sized meter especially designed for your added convenience. It is particularly easy to work with.

**Features include:**

- audible continuity checking
- 10 amps
- recessed display window for long life
- recessed lead jacks for easy insertion and maximum safety
- tilt bail
- anti-skid pads



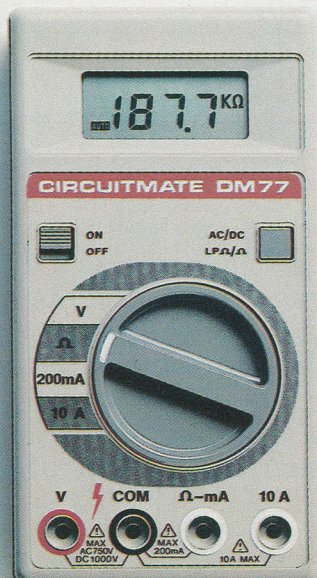
**\$69.95**

(U.S. only)

The full-sized DM40 offers you maximum convenience. Its tilt bail and anti-skid pads keep the meter steady for easy reading.

**Features include:**

- tilt bail
- anti-skid pads
- recessed jacks for easy insertion and maximum safety
- recessed display for long life
- separate diode test function



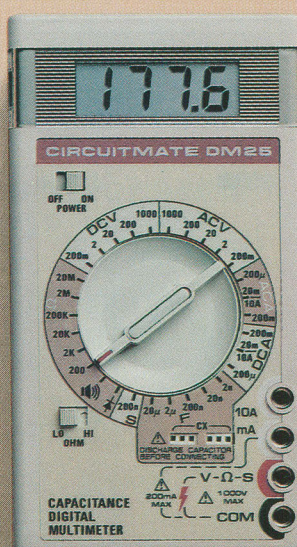
**\$76.95**

(U.S. only)

The DM77 gives you the convenience of autoranging plus 10 amps ac/dc measurement capability. You simply select the function you want, and the DM77 automatically sets the range.

**Features include:**

- audible continuity checking
- dual voltage resistance ranges
- complete autoranging
- 0.5% basic Vdc accuracy
- 10 amps



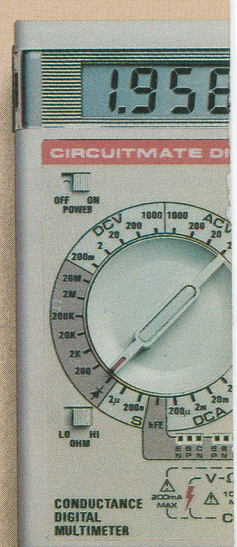
**\$79.95**

(U.S. only)

If you need to measure capacitance, the DM25 is the right Circuitmate™ for you.

**Features include:**

- capacitance
- pocket-size
- dual voltage resistance test function
- audible continuity checking
- separate diode test function
- conductance measurement capability



- separate test func



# Circuitmate™ DMM Selection Chart.

CIRCUITMATE™	DC Volts Accuracy	DC Volts Ranges	AC Volts Ranges	DC Current Ranges	AC Current Ranges	Resistance Ranges	Diode Test	Continuity Beeper	Dual Voltage Resistance Ranges	Transistor Test	Conductance	Capacitance	Autorangeing	Touch Hold	10 Amps	Size	Rotary Switch	Tilt Bail	Anti-Skid Pads	Recessed LCD Window	Recessed Jacks
<b>DM15</b>	.8%	5	5	4	4	6	✓								✓	POCKET	✓				
<b>DM20</b>	.8%	5	5	5	5	6	✓		✓	✓	✓				✓	POCKET	✓				
<b>DM40</b>	.8%	5	5	5	5	6	✓									FULL	✓	✓	✓	✓	✓
<b>DM25</b>	.5%	5	5	4	4	6	✓	✓	✓		✓	✓			✓	POCKET	✓				
<b>DM45</b>	.5%	5	5	6	6	6	✓	✓							✓	FULL	✓	✓	✓	✓	✓
<b>DM73</b>	.5%	4	4	N/A	N/A	4		✓					✓	✓		PROBE				✓	
<b>DM77</b>	.5%	5	4	2	2	5		✓	✓				✓		✓	FULL	✓			✓	

## Easy to Select

With seven Circuitmate™ Series DMMs to choose from, there's one just right for you, and your pocketbook. To select the DMM that best satisfies your needs, check the Circuitmate™ Selection Chart.

For a closer look at the Circuitmate™ DMM of your choice, see your local Beckman Distributor. To find the one nearest you, call or write: Beckman Instruments, Inc., Electronic Technologies Group, 210 Ranger Ave., Brea, CA 92621. (714) 993-8852.

**BECKMAN**



## DRAWING BOARD

*continued from page 88*

inputs are grounded. Since the  $\bar{Q}$  output is also connected to one of the legs of the first NAND gate we have two highs there and the Q output will be low. If we switch the s input to +V, the output of the second NAND gate won't change because the other leg is still being held low. Suppose we now connect the R input to ground while the s input is switched to +V. With one leg grounded, the Q output will go high and the two highs at the inputs of the second NAND gate will make the  $\bar{Q}$  output low. As you could predict, that flip-flop only responds to negative triggering because of the basic operation of the NAND gate.

The only thing to watch out for when you're using this flip-flop is to make sure that the s and R inputs aren't grounded at the same time. If that does happen, both outputs will be high and the circuit will be unstable. In practice, the last input to be grounded will decide the ultimate state of the flip-flop. But don't believe us—build it and try it yourself.

We can build the same sort of circuit with NOR gates and the flip-flop will respond to positive triggering. Use the previous discussion as a guide and trace through the operation of the NOR gate flip-flop so you understand how it works.

Now let's get back to our original problem. The circuit in Fig. 3 uses a NOR gate flip-flop to control the operation of the reset pin on the 4017. We're using NOR gates because they respond to positive triggering and the outputs of the 4017 are active high. The truth table for the flip-flop is shown in Table 1. The not-allowed state with NOR gates is having both the flip-flop inputs high. This isn't a problem, since the internal gating of the 4017 guarantees that only one output can be high at any one time.

As long as none of the switches are closed, R1 holds the input of the flip-flop low. That means that the  $\bar{Q}$  output will be low regardless of what is happening at the s input. The reset pin of the 4017 is also held low and the chip is enabled. Now let's close one of the switches and see how the circuit works.

When the selected output goes high, the R input of the flip-flop goes high and a high appears at the  $\bar{Q}$  output. This resets the 4017, the selected output goes low, and the 0 output, pin 3, goes high. Remember that the 4017 outputs go high in turn and whatever output you select will be low immediately following a reset pulse. That makes the R input low and control of the flip-flop moves over to the s input. You can see from the truth table in Table 1 that we need a positive pulse there to make the flip-flop change state and put a low at the  $\bar{Q}$  output to release the 4017's RESET pin.

The 0 output of the 4017 is inverted by NOR gate IC2-a and presents a low to one leg of NOR gate IC2-b. The other leg of the gate is connected to the input clock and when a low appears there, IC2-b goes high and resets the flip-flop. That releases the RESET pin and enables the 4017. If you keep the switch closed at the keyboard, the circuit will reset over and over at the same point. The result will be a series of pulses at the  $\bar{Q}$  output equal to the input frequency divided by whatever number you chose.

That circuit gives the 4017 a reset operation that is both synchronous and locked to the input clock. By following everything carefully you should have no trouble understanding how we did it. Remember that the reset operation starts on the positive half of the incoming clock cycle and is ended on the negative half of the same clock cycle. Since the input clock will be running faster than the pulses at any of the 4017 outputs, we don't have to worry about glitching in the count.

A side advantage of that approach is that the Q output of the flip-flop will give us an output wave that is equal in frequency to the  $\bar{Q}$  output but opposite in sign. That can come in handy for some things and is especially nice since we're getting it for free.

If you want to cascade several 4017's together to increase the range of division, you won't be able to use the carry output, pin 12. Since that pin is high for the first half of the 4017's full count and low for the second half, frequency division of less than six will mean that the carry pin never goes low. The 0 output will, however, always go through a full cycle no matter what division you're doing, so you can take your signal from there.

### The duty cycle problem

Now that we've solved the reset problem, let's look at the duty-cycle problem. In case you forgot what it is, we discovered that the duty cycle of the output would change every time we divided by a different number. It would follow the form  $1/N$  where N is the number you're dividing by. More specifically, the high time would be equal to the period of the incoming clock, and the low time would be equal to  $N - 1$  times the period.

If you're dividing by an even number, some simple gating would let you get an output with a nice 50% duty cycle but trying to do the same thing with an odd number would be—well, odd.

One of the basic rules of design is that there's a better way to do everything and that's true here. When simple problems generate overly complex solutions, it's time to scrap your whole approach and start over with a different color paper. In this case, squaring up the duty cycle not only calls for a different approach, it calls for a different IC—a different kind of counter. We'll examine that—and other mysteries—in next month's column. **R-E**

## NEW LIT

**COMPONENTS** catalog, 68 pages,  $5\frac{1}{2} \times 8\frac{1}{4}$  inches, lists semiconductors, integrated circuits, microcomputer boards, micro-processor and support circuits, transistors, diodes, capacitors, resistors, potentiometers, multimeters, connectors, sockets, PC boards, plastic enclosures, soldering aids, data and reference books, and much more. Free upon request.—**Active Electronics**, PO Box 8000, Westborough, MA 01581.

**CIRCLE 131 ON FREE INFORMATION CARD**

**OPTOELECTRONICS**, selector guide and cross reference is 20 pages on coated stock, with color,  $8\frac{1}{2} \times 11$  inches, and includes summary data on all current Motorola opto devices. Included is information on fiber-optic emitters and detectors, infrared-emitting diodes, silicon photodetectors, slotted couplers, and a broad line of optocoupler/isolators. The booklet is both a guide and a cross-reference; free on request from **Motorola Semiconductor Products, Inc.**, PO Box 20912, Phoenix, AZ 85036.

**CIRCLE 132 ON FREE INFORMATION CARD**

**DRY-TRANSFERS**, catalog is 17 pages on coated stock,  $8\frac{1}{2} \times 11$  inches, and presents a complete line of instant lettering, dry transfers, and related products for engineers, industrial designers, draftsmen, chemists, and technical illustrators. The contents include printed-circuit kits and refills, titles for electronics equipment, title and alphabet sets, full size and half-size logic symbols, printed-circuit donuts, component outlines, chemical symbol sets, standard alphabet sheets, and many other items. Free upon request from **Datapak Corporation**, 65 Seventy-First St., Guttenberg, NJ 07093.

**CIRCLE 133 ON FREE INFORMATION CARD**

**SWITCHES**, catalog is 12 pages in color on coated stock,  $8\frac{1}{2} \times 11$  inches, presenting MG Electronics' range of general-purpose switches for consumer and industrial electronics equipment.

It is complete with specification charts, dimensional drawings, and photographs that detail the company's offerings of toggle, foot, heavy-duty, contact, pushbutton, illuminated, miniature, and keylock switches, as well as fuse holders. Free upon request from **MG Electronics**, 32 Ranick Road, Hauppauge, NY 11788.

**CIRCLE 134 ON FREE INFORMATION CARD**

**COMPUTERS**, *Di\$count America Guide* (Directory of Discount Computer Suppliers) is 31 pages  $8\frac{1}{2} \times 11$  inches and contains data on books and periodicals, cable, calculators, components, diskettes, games, hardware, insurance, mainframes, minicomputers, paper, ribbons, software, supplies, tape, typesetting, typewriter conversion, and used equipment. There is a "Computer Comparison Chart" that will aid the reader in figuring the real costs of purchasing computer systems. It is available at \$3.50 postpaid from **Di\$count America Publications**, 51 East 42nd St., Room 417P, New York, NY 10017. **R-E**



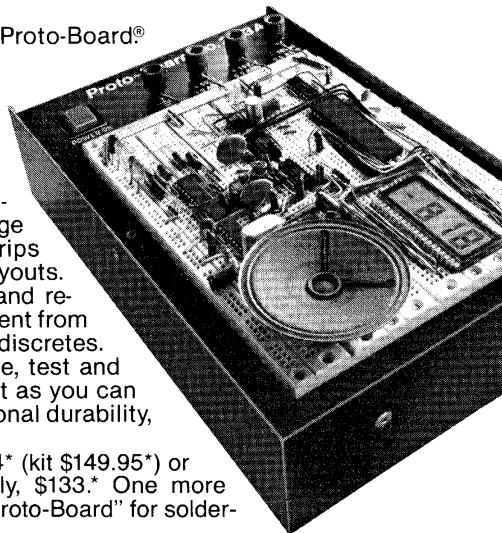
# The professional breadboard.

(For professional, hobbyist or student.)

Global Specialties' PB-203A Proto-Board®

The solderless breadboard that set the industry standard for speed, versatility and convenience. With a capacity up to twenty-four 14-pin DIPs and three regulated power supplies (one fixed, two variable), PB-203A features a large array of sockets and bus strips that emulates standard PC layouts. Permitting instant insertion and removal of virtually any component from the largest DIP to the smallest discretes. Helping you design, assemble, test and modify circuits almost as fast as you can think! And built with professional durability, for all types of applications.

Our PB-203A. Only \$174\* (kit \$149.95\*) or PB-203 with single 5V supply, \$133.\* One more reason so many people say "Proto-Board" for solderless breadboarding.



## GLOBAL SPECIALTIES CORPORATION

70 Fulton Terr., New Haven, CT 06509 (203) 624-3103, TWX 710-465-1227  
OTHER OFFICES: San Francisco (415) 648-0611, TWX 910-372-7992, Europe: Phone Saffron-Walden 0799-21682, TLX 817477  
Canada: Len Finkler Ltd., Downsview, Ontario

Call toll-free for details **1-800-243-6077** During business hours

\*Suggested U.S. resale. Prices, specifications subject to change without notice. © Copyright 1981 Global Specialties Corporation.

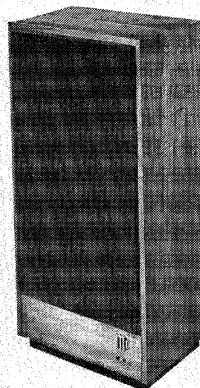
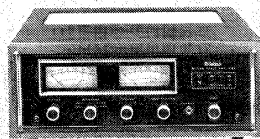
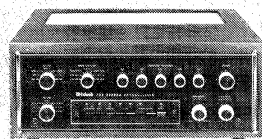
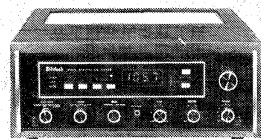
CIRCLE 96 ON FREE INFORMATION CARD

# FREE

## McIntosh

### STEREO CATALOG and FM DIRECTORY

Get all the newest and latest information on the new McIntosh stereo equipment in the McIntosh catalog. In addition you will receive an FM station directory that covers all of North America.



McIntosh Laboratory Inc.  
East Side Station P.O. Box 96  
Binghamton, N.Y. 13904-0096

RE

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

If you are in a hurry for your catalog please send the coupon to McIntosh.  
For non rush service send the Reader Service Card to the magazine.

## SELECTRIC INTERFACE

continued from page 78

### PARTS LIST—SELECTRIC ADAPTER

All parts mentioned in the Parts List for the *Electronic* and *Printer* versions, plus:  
IC10, IC11—ULN2813A or ULN2803A high-voltage/current darlington transistor array, (Sprague)

D2—D4—1N5400

SOL1—SOL10—Solenoid, 12-volts DC

**Miscellaneous:** PC boards, No. 6 hardware: (two 1 x 1/4 inch male/female threaded round spacers, two 3/8-inch flathead screws, two 1/8-inch pan-head screws, hex nut), music wire (12 inches, .031-inch diameter), plastic-covered stainless steel cable (27 inches, .020-inch diameter) 18 crimp sleeves (.040-inch diameter), wire ties, ribbon cable, etc.

**A complete kit of all parts for *Selectric* conversion, including main PC board, case, cable for typewriter, solenoids, etc. (not including memory board or memory IC's) is available from ALPHA Electronics, PO Box 1005, Merritt Is., FL. 32952 (305-453-3534) for \$169 plus \$6 postage. The mechanical adapter alone (solenoid boards and solenoids) is available for \$90 plus \$5 postage. The ULN2813A or ULN2803A IC's can be purchased for \$3 each postpaid. Florida residents please add 5% sales tax. Canadian orders please add \$2 additional to US postage; other foreign orders please add \$6 additional to US postage.**

through holes, so those procedures are not necessary.)

That's all we have room for now, but we still have a lot to do. That includes assembling the boards, and connecting them between your computer and typewriter (or printer). We'll begin that next time when we continue this article.

R-E

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION		DATE OF FILING	
1. TITLE OF PUBLICATION		2. ISSUE DATE	
RADIO-ELECTRONICS		JULY 1, 1983	
3. FREQUENCY OF ISSUE		4. NO. OF ISSUES PUBLISHED	
Monthly		12	
5. COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		6. COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
200 Park Ave., South, New York, NY 10003		200 Park Ave., South, New York, NY 10003	
7. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		8. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
9. OWNER OF PUBLICATION (Include City, County, State and ZIP Code; not address of principal office or business office)		10. OWNER OF PUBLICATION (Include City, County, State and ZIP Code; not address of principal office or business office)	
McIntosh Laboratory Inc., 200 Park Ave., South, New York, NY 10003		McIntosh Laboratory Inc., 200 Park Ave., South, New York, NY 10003	
11. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		12. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
13. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		14. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
15. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		16. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
17. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		18. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
19. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		20. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
21. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		22. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
23. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		24. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
25. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		26. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
27. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		28. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
29. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		30. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
31. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		32. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
33. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		34. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
35. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		36. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
37. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		38. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
39. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		40. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
41. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		42. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
43. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		44. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
45. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		46. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
47. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		48. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
49. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		50. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
51. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		52. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
53. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		54. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
55. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		56. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
57. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		58. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
59. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		60. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
61. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		62. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
63. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		64. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
65. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		66. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
67. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		68. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
69. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		70. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
71. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		72. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
73. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		74. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
75. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		76. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
77. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		78. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
79. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		80. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
81. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		82. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
83. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		84. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
85. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		86. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
87. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		88. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
89. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		90. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
91. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		92. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
93. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		94. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
95. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		96. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
97. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		98. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	
99. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)		100. FULL NAME AND COMPLETE MAILING ADDRESS OF PUBLISHER (Include City, County, State and ZIP Code; not address of principal office or business office)	
Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003		Lester S. Stankiewicz, 200 Park Ave., South, New York, NY 10003	

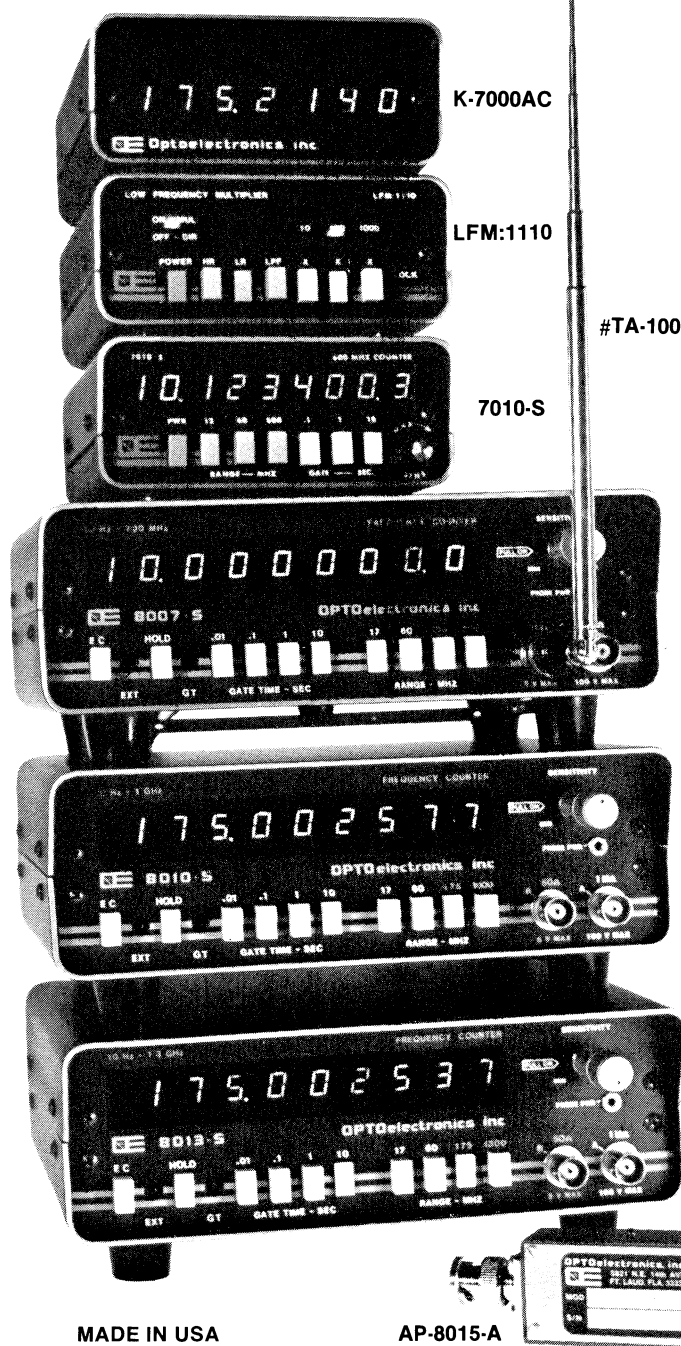




# FREQUENCY COUNTERS to 1.3 GHz

By **OPTOelectronics inc.** Ft. Lauderdale, Florida

EST. 1974



#TA-100 Ant.

**MODEL K-7000-AC** 10 Hz to 550 MHz counter. 50 Ohm & 1 Megohm inputs via BNC type connectors on rear panel. This model is available in optional kit form.

#K-7000-AC counter assembled 115VAC/12VDC ..... \$150.  
#K-7000-ACK counter kit form ..... 120.  
#Ni-Cad-70S internal Ni-Cad battery pack ..... 25.

**MODEL LFM:1110** Low frequency multiplier. A frequency counter accessory enabling tone frequencies to be counted faster and more accurately. Has low pass filter for off-the-air. Tone-squelch measurements. BNC input/output.

#LFM:1110 115VAC/12VDC ..... \$150.

**MODEL 7010-S** 10 Hz to 600 MHz counter. 50 Ohm & 1 megohm inputs via BNC type connectors on rear panel.  $\pm 1$  PPM TCXO standard  $\pm 0.1$  PPM TCXO time base optional for greater accuracy. 10 mV average sensitivity. Very compact 8 1/2 digit counter: Size 2" H x 4" W x 5" D, 1 lb.

#7010-S 600 MHz counter 115 V AC/12 V DC ..... \$235.  
#TCXO-80  $\pm 0.1$  PPM TCXO time base ..... 75.  
#Ni-Cad-76 Internal Ni-Cad Battery Pack ..... 25.

**MODELS 8007-S, 8010-S, 8013-S** Deluxe series with frequency ranges of 10 Hz to 700 MHz, 1 GHz and 1.3 GHz. Standard features include: external clock input/output, excellent sensitivity, sealed  $\pm 1$  PPM 10 MHz TCXO time base, 4 gate times, 9 digit resolution to 175 MHz, front panel power jack for optional Broadband Preamp accessory, 115 V AC or 12 V DC operation, high quality compact construction housed in rugged aluminum cabinet. Optional features: internal Ni-Cad rechargeable battery operation, precision  $\pm 0.1$  PPM TCXO or  $\pm 0.05$  PPM proportional oven (OCXO) time base. All time base oscillators, including the standard TCXO, have 10 turn calibration adjustment accessible from rear panel. Size 3" H x 7 1/2" W x 6 1/2" D. 2 3/4 lbs.

#8007-S 700 MHz counter ..... \$350.  
#8010-S 1 GHz counter ..... 425.  
#8013-S 1.3 GHz counter ..... 475.

#### OPTIONS:

#TCXO-80  $\pm 0.1$  PPM TCXO time base ..... 75.  
#OCXO-80  $\pm 0.05$  PPM (prop. oven) OCXO time base ..... 125.  
#Ni-Cad-86 Internal Ni-Cad battery pack ..... 60.

**MODEL AP-8015-A** Broadband Preamp with 25 dB nominal gain from 1 MHz to 1 GHz, 10 dB gain at 1.3 GHz. Noise Figure less than 5.5 dB. supplied with AC adaptor or may be powered from power jack on 80XX-S series counters.

#AP-8015-A ..... \$195.

#TA-100 Antenna, RF pick-up telescope style with right angle elbow and BNC connector. .... \$12.

- FULL YEAR GUARANTEE — ALL PRODUCTS.
- CERTIFIED NBS TRACEABLE CALIBRATION.
- ALL ALUMINUM CABINETS.

MOST ITEMS SHIPPED FROM STOCK  
Prices/Specifications subject to change without notice or obligation.

MADE IN USA

AP-8015-A

MODEL	RANGE (FROM 10 Hz)	TIME BASE		AVERAGE SENSITIVITY		GATE TIMES	MAX RESOLUTION					SENSITIVITY CONTROL	EXT CLOCK INPUT/OUTPUT	METAL CASE	PROBE POWER JACK
		FREQ	STAB-DESIGN	BELOW 500 MHz	ABOVE 500 MHz		12 MHz	17 MHz	60 MHz	175 MHz	MAX FREQ				
K-7000-AC	550 MHz	5.24288	$\pm 1$ PPM-RTXO	15 mV -24 DBM	N/A	(2) .1, 1 SEC	10 Hz		100 Hz			No	No	Yes	No
7010-S	600 MHz	10.0 MHz	$\pm 1$ PPM-TCXO $\pm 0.1$ PPM-TCXO	10 mV -27 DBM	20 mV -21 DBM	(3) .1, 1, 10 SEC	.1 Hz	1 Hz		10 Hz		Yes	No	Yes	No
8007-S	700 MHz	10.0 MHz	$\pm 1$ PPM-TCXO	10 mV -27 DBM	20 mV -21 DBM	(4) .01, .1, 1, 10 SEC	.1 Hz	1 Hz	10 Hz		Yes	Yes	Yes	Yes	Yes
8010-S	1 GHz		$\pm 0.1$ PPM-TCXO												
8013-S	1.3 GHz		$\pm 0.05$ PPM-OCXO												

**OPTOelectronics inc.**  
5821 NE 14 AVE. FT. LAUDERDALE FL 33334

VISA  
MC  
COD

**TOLL FREE 800-327-5912**  
**FREE** FLA 305-771-2050

To US and Canada Add 5% to max of \$10. per order for shipping/handling  
Foreign orders add 15%

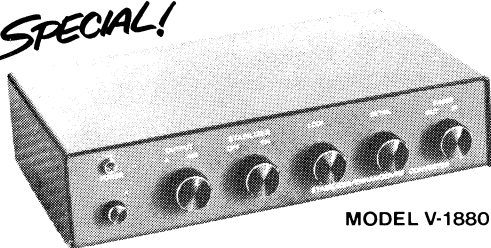
CIRCLE 62 ON FREE INFORMATION CARD



# State-of-the-Art VIDEO EQUIPMENT

Quality • Low Prices • Immediate Delivery

**SPECIAL!**



MODEL V-1880

**BP STABILIZER/IMAGE ENHANCER/  
RF CONVERTER/VIDEO FADER/2-WAY  
DISTRIBUTION AMPLIFIER**

**\$119<sup>95</sup>**

**OUR PRICE**

Contains five units in one; stabilizer (video guard remover); image enhancer; video to RF converter; video fader; and dual output distribution amplifier. **Stabilizer** Will correct entire range of copy guard distortion such as jitter, vertical roll or black bar travelling through picture.

**Enhancer** Attain best picture for your preference.

**RF Converter** Allows your TV set to receive video and audio signals from your image enhancer, guard stabilizer, video camera, computer, VCR, etc. The direct video signal from any video component can be fed into the V-1880 and converted to a usable RF signal that can go to your TV antenna terminals.

**Video Fader** Used to produce fade ins and outs.

**NEW!**



MODEL V-2250

**BP TV TO STEREO  
AUDIO ADAPTOR/  
ENHANCER \$19<sup>95</sup>**

**OUR PRICE**

Easily connects to any TV and Stereo Amplifier or simulated stereo sound. Makes taping TV Audio simple - TV can be located any distance from stereo. Delivers two channels of simulated stereo. With noise eliminator and special output level controls. Frequency response: 50 Hz - 15,000 KHz.

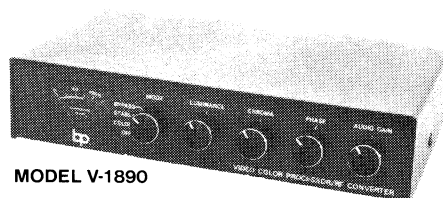
**NEW!**

**BP VIDEO COLOR PROCESSOR/RF CONVERTER/  
STABILIZER/3-WAY DISTRIBUTION AMPLIFIER**

**OUR PRICE**

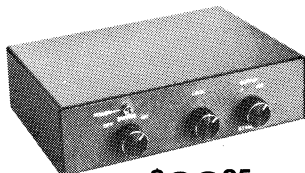
**\$189<sup>95</sup>**

Corrects video signal directly into tape not just on playback. Luminance meter monitors brightness levels for quality recordings. Can also be used between video cameras and VCR, VCR and VCR and from VCR to TV during playback mode. Corrects off-color tapes. Center detent, luminance, chroma, phase and audio controls. Stabilizer for removing copyguard.



MODEL V-1890

**BP VIDEO GUARD STABILIZER  
MODEL V-1875**



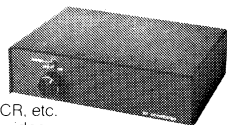
**OUR PRICE \$39<sup>95</sup>**

Has self contained A&B and bypass switch. Many movies, concerts and special programs for sale or rental are copy guarded. This removes copy guard and allows you to make copies. Many TV sets will not play prerecorded tapes because copy guard causes picture to roll and jitter, turn to snow or disappear. Video Guard Stabilizer removes copy guard from signal.

**BP RF CONVERTER/MODULATOR  
MODEL V-1885**

**OUR PRICE \$39<sup>95</sup>**

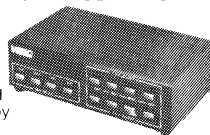
Allows your TV to receive video and audio signals from image enhancer, guard stabilizer, video camera, computer, VCR, etc. The outputs of many video components cannot be directly hooked up to the VHF antenna terminals on your TV set. This problem is solved by using the Model V-1885 RF Converter. Converts video signal from any video component to adjustable RF signal at antenna terminals. Allows your VCR output to feed two TV sets at the same time, with virtually no signal loss.



**BP VIDEO SELECTOR CENTER  
MODEL V-4803**

**OUR PRICE \$49<sup>95</sup>**

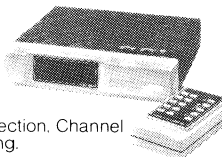
A switcher that can accept 6 inputs and direct them to 3 outputs. Utilizes switch similar to one used on home VCR's. You avoid signal loss incurred by using splitters.



**JERROLD 58 CHANNEL  
CORDLESS TV CONVERTER  
MODEL LCC-58 (DRX 3-105)**

**OUR PRICE \$99<sup>95</sup>**

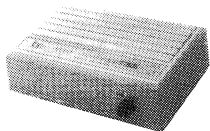
Receive up to 58 TV channels, Remote TV Control. Attaches to any age or model TV in minutes. No tools required, On/Off button, Channel selection, Channel Stepping, Fine Tuning.



**BP UHF CABLE CONVERTER  
WITH FINE TUNING/46 CHANNEL  
MODEL V-5746**

**OUR PRICE \$24<sup>95</sup>**

Fully shielded oscillator eliminates hearing bone distortion. For Beta/VHS recording. Record & use TV's remote control. Complete programming of VTR.



**BP VIDEO GUARD STABILIZER/  
RF CONVERTER  
MODEL V-1877**



**OUR PRICE \$69<sup>95</sup>**

Same as V-1875 but with a built-in RF Converter that gives the model V-1877 an RF output which can be fed directly to the antenna terminals of a TV set. This enables you to remove the copy guard from a pre-recorded tape and view it on a TV using only a VCR.

**Use as an RF Converter only.** Used in conjunction with your TV, you can feed direct audio and video signals from any video device such as video camera, computer, portable VCR, etc.

**BP IMAGE ENHANCER  
MODEL V-1860**

Dramatically improves performance of video cameras and VCR's (off-the-air or second generation recordings), by compensating for deterioration of detail and sharpness. Includes video distribution amplifier with two video outputs.



**OUR PRICE \$49<sup>95</sup>**

**FORDHAM**  
260 Motor Parkway, Hauppauge, N. Y. 11788

Master Charge  
VISA  
COD  
Money Order  
Check

N. Y. State  
residents add  
appropriate  
sales tax.

ADD FOR SHIPPING AND INSURANCE  
\$250.00 ..... \$4.50  
\$251.00 to 500.00 ..... 6.50  
501.00 to 750.00 ..... 8.50  
751.00 to 1000.00 ..... 12.50  
over 1000.00 ..... 15.00

COD's extra (required 25% deposit)

**TOLL FREE (800) 645-9518**  
in N. Y. State call 800-832-1446



# HOBBY CORNER

This and that

EARL "DOC" SAVAGE, K4SDS, HOBBY EDITOR

THIS MONTH WE ARE GOING TO TAKE ANOTHER dip into our mailbag. One of our readers, Gareth Ridout, is having a bit of trouble with a project he is working on. The schematic diagram for the device he is building calls for a 4016 CMOS switch. That IC contains four SPST switches like the one shown in Fig. 1-a.

The contacts of that switch are between pins 1 and 2. The control voltage is applied to pin 13. When 13 is made high, the contacts are closed.

The problem is caused by the fact that the schematic itself shows the switches as SPDT devices. That would mean that the IC can be substituted for a 4053, which contains three SPDT switches (one is shown in Fig. 1-b).

Unfortunately, the text is of no help in determining which is correct. Well,

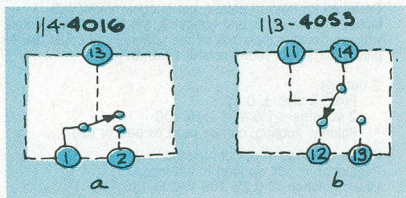


FIG. 1

Gareth, we have found that it is the schematic that is usually correct when there is a discrepancy between what it shows and the parts list accompanying it. In this case, we would use the 4053 IC.

Gareth also asks whether or not a 4066 IC can be substituted for a 4016. The answer is that it is even better than the 4016 in most uses. The 4066 is an improved version that has a lower closed resistance. On the other hand, the 4016 has lower

leakage and should be used in a circuit when that characteristic is most important.

## Receiver drift

A receiver that drifts in frequency is a real pain—you must tune and re-tune as you attempt to listen to a station. The problem can be especially bad when you are on a shortwave band and is made even worse as you make the bandpass narrower to eliminate interference from adjacent stations.

Richard Fry has asked how to "remedy the most irksome problem" of drift in older tube-type communication receivers. Indeed, drifting can be quite frustrating and the problem is not limited to tube receivers nor to old ones. Even new transistor receivers can be plagued with drift

## TIMEX SINCLAIR

### Software

#### Top Games

Mr. Munchie — (Arcade)	\$14.95
Speed Snake — (Arcade)	\$14.95
Bridge — (Card)	\$14.95
Chess I.....	\$14.95
Chess Master.....	\$24.95
Trader Trilogy	
(Fantasy).....	\$14.95
Alien Space Ship	
(Adventure).....	\$14.95

#### Home & Business

Personal Financial Pack	
(2 tapes).....	\$29.95
Stock Market Planning	
(2 tapes).....	\$29.95
Business Cash Management	
(2 tapes).....	\$29.95
Diet Programme	
(2 tapes).....	\$29.95

#### Programming Aids

Fastload (Load and save	
6 times faster).....	\$19.95
ZX Assembler.....	\$14.95
ZX Bug (Monitor &	
Disassembler).....	\$14.95
Toolkit (9 new functions)	\$14.95

### LANGUAGES

Tiny Logo.....	\$19.95
Forth.....	\$29.95

### Hardware Specials

64 K RAM.....	\$99.95
Professional Keyboard with	
Metal Case.....	\$79.95
Memotech 16K RAM.....	\$29.95

### Books

Timex Sinclair	
Learning Course	
with Binder,	
2 Program Tapes	
	\$24.95

### Free Catalog

All software is compatible with  
**TS1000 TS1500 ZX81** Computers!  
**Call or write NOW!**  
**COMING SOON!**  
 New TS2068 software!

**GLADSTONE**

Electronics Inc.

1585 Kenmore Ave.  
 Buffalo, NY 14217

Mail Orders: VISA, MASTERCARD.  
 Cheques or Money Orders. Add \$1.50 shipping.

In Canada: 1736 Avenue Rd., Toronto, Ont. M3J 2W6 800-268-3640

**ORDER TOLL FREE**  
**800-833-8400**

Have VISA or MASTERCARD ready!  
 In New York  
 716-874-5510

## Just in time for Christmas! The Handheld Digital Multimeter A practical, useful gift!

The IM-2215 Handheld Digital Multimeter takes the high resolution of a bench instrument into the field with measuring capabilities to 100  $\mu$ V, 1  $\mu$ A and 1 ohm. Its 3½ digit liquid crystal display shows DC voltages up to 1000 V, AC voltages up to 750 V, DC and AC current up to 2000 mA and resistances up to 20 megohms. Side pushbuttons allow quick range switching and easy one-handed operation. Kit priced at \$99.95. Send for complete details today using the coupon below. Visa and MasterCard orders call TOLL-FREE: 1-800-253-0570.



**Heathkit**  
 Heath  
 Company

## FREE COLORFUL CATALOG

Please send me my FREE Heathkit Catalog featuring the IM-2215 Handheld Digital Multimeter and many other quality electronic kits.

Name \_\_\_\_\_  
 Address \_\_\_\_\_ Apt. \_\_\_\_\_  
 City \_\_\_\_\_  
 State \_\_\_\_\_ Zip \_\_\_\_\_

MAIL TO: Heath Company, Dept. 020-120  
 CL-765 Benton Harbor, MI 49022







but older tube devices are better—if that's the word—at it.

Space won't permit going into much detail, Richard, but we can point you in several directions that may help. We figure that your's is just one of thousands of such receivers that could stand some sprucing up.

One of the first things you should do to an old receiver of any kind is to take a hard look at the capacitors inside of it. You may even find some old paper capacitors in there! They are the worst offenders but others can change value and develop excess leakage with age, too. The thing to do, of course, is to replace them with new, modern units (tantalum, poly, etc.). You could test the old ones but the cost of replacement is low and it's quicker just to clip the old ones and solder in new ones. If you replace just one real loser, you will be amazed at the obvious improvement.

Most often, drift originates in the oscillator circuits of a receiver. Temperature changes can run the frequencies all over the map. As the set warms up to operating temperature, drift is at its worst. One way to avoid that is to leave the receiver on all the time. That way, it stays at operating temperature (and the cost of electricity is not significant).

Assuming that your set has the filaments ("heaters") wired in parallel (not series), there is an old trick that is almost as good as leaving it on all the time. It may

do just as well, depending on the construction of the receiver. Old-timers frequently installed a small filament transformer that did not turn on and off with the main switch. That was connected to the filaments of the oscillator tubes (or sometimes all of the filaments in the set). Thus, those tubes stayed at operating temperature as long as the line cord remained connected to the wall socket.

Believe it or not, but some sensitive receivers can be affected by drafts in the air. In such cases, it will help to place it in locations where air from a radiator or hot air vent will not blow over it. And don't back it up to a window where winter drafts can reach it. The last suggestion is to stabilize the voltages, especially those on the oscillators and mixers. You can use old voltage regulator tubes if you can find them, and find space to mount them, but solid state regulators or Zeners are a better solution.

By the way, did you know that audio-power output transistors can function as Zeners? Only one junction is used, of course, so even some "blown" transistors can be used. You must test them for their knee voltages, which you will find often to be in the range around 100 volts, but they work great and are much cheaper than the "bought" variety.

Well, Richard, that should give you a good start. We hope you get that old unit in top shape.

## Circuit analysis

Frequently, we receive a letter describing a circuit or device that a reader has built. The question usually is why it doesn't work or why it works in the way that it does. Sometimes, we can offer a suggestion or two, but we surely can't if the schematic is not included with the inquiry.

Just the other day, we received another such letter. The reader gave a fine word-description of the circuit and the problem but there was no schematic. The problem might have been caused by at least a dozen things. Without a schematic we have no way to narrow down the possibilities so we can't help.

The moral of that story is that you should send us a schematic whenever you ask about a specific circuit. We still may be unable to point out your difficulty, but without that schematic, there is *no* chance of help from here.

## Surge filter

Larry Zimmerman wrote to find out how he could protect his Timex/Sinclair 1000 from troublesome and dangerous powerline surges without spending more than he spent on the computer itself. By this time, Larry, you most likely have seen the great multi-purpose powerline-filter construction article on page 57 in the September issue of **Radio-Electronics**.



# FREE SOCKETS!

Send **\$1.00** postage and handling for DIP Socket Deal!

One each of 8, 14, 16, 24 and 40 pin tin low profile DIP Sockets

plus

we will send you FREE our 56 page catalog with \$1.00 OFF Coupon on any purchase.

How can you lose?

**SINTEC COMPANY**  
28 8th Street  
Box 410  
Frenchtown, NJ 08825  
(201) 996-4093

We Carry Over 1500 Parts in Stock!!

Fill in below for Socket Deal

☐ I want the Socket Deal    Enclosed is my \$1.00 cash.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

## Just in time for Christmas!

## The Most Accurate Clock

## A great gift idea!

The most accurate consumer clock ever made! The Heath GC-1000 Most Accurate Clock sets and corrects itself automatically by receiving shortwave broadcasts from the National Bureau of Standards. Microprocessor circuitry displays hours, minutes, seconds and even tenths of seconds. Kit priced at \$249.95. Send for complete details today using the coupon below. Visa and MasterCard orders call TOLL-FREE: 1-800-253-0570.





**Heathkit®**  
Heath  
Company

FREE COLORFUL CATALOG

Please send me my FREE Heathkit Catalog featuring the GC-1000 Most Accurate Clock and many other quality electronic kits.

Name \_\_\_\_\_

Address \_\_\_\_\_ Apt. \_\_\_\_\_

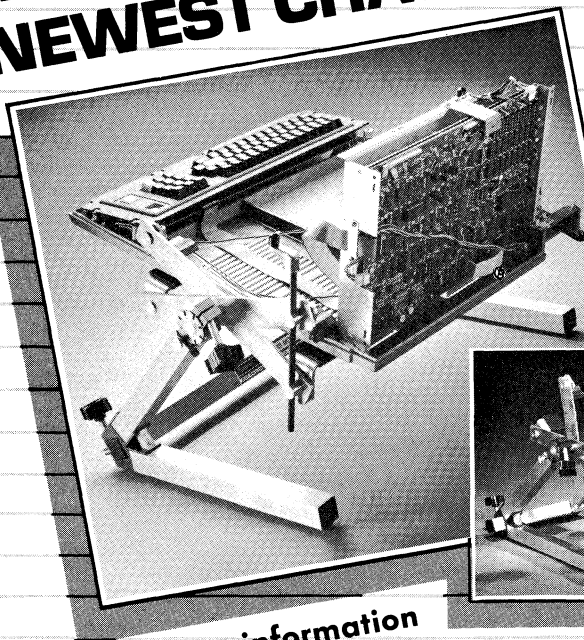
City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

**MAIL TO:** Heath Company, Dept. 020-121  
CL-766 Benton Harbor, MI 49022

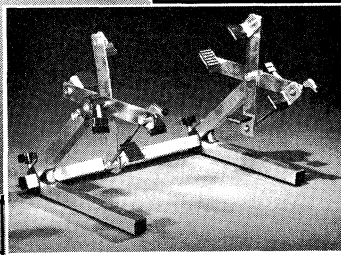


# THE INDUSTRY'S NEWEST CHASSIS MOUNT



Loaded with  
features and  
advantages never  
before available  
for  
only \$199.95

Price subject to change  
without notification.



For complete information  
contact:

**PANAVISE®**

2850 East 29th Street Long Beach, California 90806 (213) 595-7621

CIRCLE 31 ON FREE INFORMATION CARD

That should take care of your problem provided, of course, that it is caused by surges. We presume that you are aware of the heat problem in the 1000. The voltage regulator in the computer sometimes cuts out because of overheating. When the regulator cools a bit, the machine can be operated once again.

The solution to overheating is to drill a few ventilation holes in the case and/or replace the regulator heat sink with a larger one.

## More on cassette machine speed

We recently received a nice letter from Ronald Gronsby about changing the speed of cassette recorder/players. He says that he has not had success with decreasing the size of the capstan and when making a pulley smaller, he prefers to use a small lathe-like tool to shave it, rather than a file.

Even more interesting: Ronald had dissected some of the shunt motors from inexpensive cassette machines. By removing the outer motor covering you can see two small centrifugal switches in a slot in the case. Turning the armature will reveal two screws for each switch—a larger mounting screw and a smaller adjusting screw.

The smaller screws can be turned to change the speed of the motor. Counter-clockwise slows the motor and clockwise speeds it up. You should try to turn both screws the same amount in order to keep the motor in balance.

Thanks for sharing that useful information with us, Ronald.

## Your questions and topics

Don't forget to send us any questions or suggestions for topics you would like to have covered in this column. Those of the greatest general interest will appear here in the future. Now, what was it you wanted to know?

R-E

## AN INVITATION

To better meet your needs, "Hobby Corner" has undergone a change in direction. It has been changed to a question-and-answer form. You are invited to send us questions about general electronics and its applications. We'll do what we can to come up with an answer or, at least, suggest where you might find one.

If you need a basic circuit for some purpose, or want to know how or why one works, let us know. We'll print those of greatest interest here in "Hobby Corner." Please keep in mind that we cannot become a circuit-design service for esoteric applications; circuits must be as general and as simple as possible. Please address your correspondence to:

Hobby Corner  
Radio-Electronics  
200 Park Ave. South  
New York, NY 10003

**NOW!**

## GET IBM-PC Capacity at a Fraction of IBM'S Price!

New NETRONICS 16 Bit EXPLORER 88-PC Kit  
Starts at Just \$399.95 - Accepts All IBM Peripherals.

It's true! Now you can enjoy the power of the Intel 8088—the same microprocessor which powers the IBM-PC—and run any program compiled for the IBM-PC...starting at only \$399.95!

Take this easy, low cost way to learn 16-bit technology! Two-board system features:

1. 8088 mother board with 5-slot expansion bus; accepts any hardware designed for IBM-PC; and
2. 64K memory board, expandable to 256K; with IBM compatible RS232 communications port.

Any disk-operating system which works on the IBM will work directly on the EXPLORER 88-PC, and all programs compiled for the IBM will run on it.

The system monitor ROM included in the Starter system features a user-friendly operating system that allows easy program generation and debugging. The commands include display/modify memory...display/modify registers...input/output data to I/O ports...block moves...single-step trace mode...go/run with optional breakpoint and register reports...cassette load/save with file labels...plus a complete system test program that tests and reports condition of ROM, RAM, cassette interface, timer, DMA controller, interrupt controller, and the communications port. These test programs not only allow easy debugging of software but they serve as hardware and software learning tools.

The EXPLORER 88-PC STARTER KIT includes a mother board, memory/I/O board, all components needed, sockets for IC's used, one 62-pin bus connector and complete assembly/test instructions. All you need is a soldering iron, solder, a power supply, and a standard RS232 terminal (Netronics has 2 low-cost ones to choose from).

Explorer 88-PC Starter Kit...\$399.95

- + 10.00 p&i
- ☐ (wired & tested, add \$100.00)
- ☐ Extra 62-pin connectors at \$4.25 ea. + 1.00 p&i.

Use your own terminal with the EXPLORER 88-PC or, if you plan to expand it to be fully IBM compatible, we offer our IBM compatible keyboard and an IBM compatible color graphics board (only available wired and tested).

- ☐ IBM compatible keyboard...\$299.95 + 10.00 p&i.
- ☐ IBM compatible color board...\$299.95 + 10.00 p&i.
- ☐ Additional ROM required...\$35.00.

Set your own pace! Invest and learn, at the rate YOU want! Add to your EXPLORER 88-PC: Deluxe heavy-duty steel cabinet that houses either two 5 1/4" floppies or a 5 1/4" hard disk with one floppy. This cabinet features a brush-finish front panel and a wood-grained sleeve.

- ☐ EXPLORER 88-PC Cabinet...\$199.95 + 18.00 p&i.

A heavy-duty open frame power supply with fan that can be used in your own cabinet or installed into the Netronics cabinet is available as follows:

- ☐ 10 amp power supply for system + 2 floppies...\$149.95 + 8.00 p&i.
- ☐ As above + extra power for 1 hard disk...\$169.95 + 8.00 p&i.
- ☐ IBM compatible disk controller board. Controls four 5 1/4" floppy drives (w/2 drive cable). Available wired and tested only...\$250.00 + 8.00 p&i.
- ☐ Monitors and BIOS source listings: available on either disk or hard copy at \$35.00. Please specify format and system required.
- ☐ INTEL 8086/8088 user manual...\$15.00 + 1.50 p&i.
- ☐ THE 8086 BOOK by RECTOR & ALEX...\$16.00 + 1.50 p&i.

- ☐ Special IBM compatible system: with keyboard, color graphics board, floppy disk controller, 64K RAM, cabinet, standard power supply and a single 5 1/4" floppy drive...\$1899.95 + 25.00 p&i.

IBM compatible hard disks, built-in modern board, eeprom burner, print buffer system plus more will be available shortly.

Over 100 EXCLUSIVE Products and Kits—including the 'Speak Easy' universal voice synthesizer, a Diagnostic card with built-in logic probe for the IBM-PC, terminals, monitors, the ELF and EXPLORER 85 computers, and much more, are described in our upcoming catalog. It's yours FREE if you check here ☐



"p&i" stands for "postage and insurance".

CALL TOLL FREE 1-800-243-7428 for Charge Card Orders.  
In Conn., call 203-354-9375, Conn. res. add sales tax.

TO ORDER BY MAIL, CHECK BOXES FOR PRODUCTS DESIRED AND MAIL ENTIRE AD TO:



**NETRONICS R&D LTD.**

333 Litchfield Rd., New Milford, CT 06776

☐ Amount enclosed ☐ OR Charge my ☐ VISA ☐ MASTERCARD  
Acct. No. \_\_\_\_\_ Exp. Date \_\_\_\_\_  
Signature \_\_\_\_\_  
PRINT NAME \_\_\_\_\_  
Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_



# SERVICE CLINIC

## More on opening your own shop

JACK DARR, SERVICE EDITOR

WE STARTED TO TALK ABOUT WHAT IT takes to open your own service shop back in the September issue of **Radio-Electronics**. This seems like a good time to look at that topic a little further.

Pay attention to what we're about to say because it is important. When talking about opening your own business, the key word is *business*: to survive, you've got to run your business like a business. You're the whole crew: technician, bookkeeper, parts man, collector, and janitor. So, if you don't do a job, it won't get done! Here are some helpful ideas.

First of all, know what it costs you to do business. That is how you figure your prices. Add up all your monthly expenses: light, heat, phone, delivery costs, rent, taxes—everything. Get those figures, then divide that by the number of weeks,

then the number of days (5 or 6) you work. Divide that by 8 hours in a day and you've got your costs for every hour. Add your profit to that (without a profit you would starve pretty quickly) and you've got your basic service charge per hour. Stick to it. If you don't, you're losing money.

Secondly, keep your books up to date. It's a good idea to use a set of the special TV-service forms; you can get those at your TV-parts supply house. Those forms have an original and a duplicate. Give the customer the original and the duplicate serves as your job-record. Also, it's a good idea to enter each job in a "Day Book" under the customer's name. That makes it easy to run up your totals at the end of each month, for tax purposes and sales tax (don't forget to collect that; it can add up in only a month). You have to make

those tax reports, so make it as easy as you can. Do that every day or you'll wind up way behind.

Finally, keep the shop clean. When you finish a job, check it out, then clean up the bench. Put tools back, and above all put your service data back in the file. Never leave it lying around in heaps. If you do, you will waste about \$3.00 worth of time hunting for it! You sell your time, so don't waste it!

### The new man in town

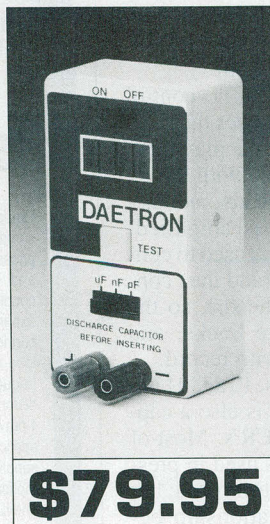
When you come into a new town/city, you need to get out and meet the people. After you get set up, go out and ring a few doorbells. Tell the people you're a new TV technician in the town/neighborhood, and you want to meet them. Give them a card with your name and phone number

## WHY SPEND A FORTUNE ON A DIGITAL CAPACITANCE METER?

As a matter of fact you don't have to pay \$180 to \$500 and up anymore for a Digital Capacitance Meter that is both dependable and rugged with good accuracy. The MC100A comes completely assembled and calibrated and at \$79.95 is an outstanding value. The extensive range of 30 pF to 9,999 uF (no external meters required) and true hand held portable size (only 4 3/4" x 2 1/2" x 1 1/2") make the MC100A an extremely practical and easy to use instrument for the hobbyist technician or engineer.

### CHECK THESE OTHER FEATURES

- \*Basic accuracy 2% ( $\pm$  one count) on pF, nF ranges, 5% ( $\pm$  one count) on uF range.
- \*Uses single 9V battery (not included).
- \*Decimal points light up when battery is low or when capacitor is overrange.
- \*Full 4 digit high efficiency LED display uses special circuitry to save on batteries.
- \*Maximum conversion time for 9,999 uF is less than 6 seconds.
- \*Constructed with a tough impact resistant plastic case.
- \*90 day parts and labour warranty.



**\$79.95**



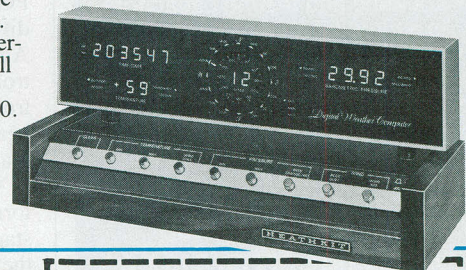
**DAETRON**  
935 THE QUEENSWAY, BOX 641  
TORONTO, ONTARIO M8Z 5Y9  
(416) 499-7221  
DEALER ENQUIRIES INVITED

### PLEASE SEND ME

(Quantity) MC100A(s) @ \$79.95 U.S. (Canadian residents send \$89.95 CDN.) \$ \_\_\_\_\_  
 Ontario residents add 7% PST \$ \_\_\_\_\_  
 Postage — \$2.25 for U.S. \$1.85 for Canada (per instrument) \$ \_\_\_\_\_  
☐ I ENCLOSE CHECK ☐ MONEY ORDER ☐ BILL MY VISA ☐ TOTAL \$ \_\_\_\_\_  
☐ VISA CARD NO. \_\_\_\_\_ EXPIRY DATE \_\_\_\_\_ SIGNATURE \_\_\_\_\_  
 Immediate shipping on orders with money orders or VISA.  
 Personal checks please allow 2 to 3 weeks for clearance.  
 NAME \_\_\_\_\_  
 ADDRESS \_\_\_\_\_  
 CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP CODE \_\_\_\_\_  
 MAIL TO DAETRON 935 THE QUEENSWAY BOX 641  
 TORONTO ONTARIO M8Z 5Y9

## Just in time for Christmas! The Computerized Weather Station Perfect for any season!

This easy-to-assemble ID-4001 personal weather computer gives you up-to-the minute meteorological readouts including time/date, indoor and outdoor (F or C) temperatures, wind speed and direction, and barometric pressure. Past weather data can be recalled with the touch of a button. Kit priced at \$399.95. Send for complete details today using the coupon below.  
 Visa and MasterCard orders call  
 TOLL-FREE:  
 1-800-253-0570.



### FREE COLORFUL CATALOG

Please send me my FREE Heathkit Catalog featuring the ID-4001 Computerized Weather Station and many other quality electronic kits.

Name \_\_\_\_\_  
 Address \_\_\_\_\_ Apt. \_\_\_\_\_  
 City \_\_\_\_\_  
 State \_\_\_\_\_ Zip \_\_\_\_\_  
 MAIL TO: Heath Company, Dept. 020-122  
 CL-767 Benton Harbor, MI 49022

**Heathkit®**  
Heath  
Company

CIRCLE 15 ON FREE INFORMATION CARD



# The "OUT FRONT" DMM



## HICKOK'S LX-306 PIED PIPER with exclusive Vari-Pitch®

... combines the best of DMM's, analog meters, logic probes, tracers and continuity testers into one compact unit. The LX-306 offers 0.25% accuracy and all functions and ranges featured by other leading DMMs; PLUS, VARI-PITCH, the audible DMM tone system that obsoletes all others.

VARI-PITCH changes tone proportionate to the signal input. Its usage is limited only by your imagination. Imagine:

- Troubleshooting by character or "signature" sound.
- Detecting ripple or noise on the power supply line.
- Quickly locating intermittents.
- Locating and testing capacitors in a circuit.
- Making analog-type peaking and nulling adjustments.
- Reducing troubleshooting time by 25% or more.

The LX-306 is the ideal DMM for tough jobs and busy schedules. Built to fit your hand and your budget!

LIST PRICE ~~\$155.00~~

LIMITED TIME OFFER **\$139.00**

See your Hickok distributor, or contact:

**HICKOK**  
the value innovator

THE HICKOK ELECTRICAL INSTRUMENT CO.  
10514 Dupont Avenue • Cleveland, Ohio 44108  
(216) 541-8060 • TWX: 810-421-8286

on it. You may get a few doors slammed in your face, but keep on. That technique worked years ago, and, given a chance, it still works today.

It's also a good idea to visit the other TV shops in your neighborhood. Introduce yourself, and be sure to tell them you're not going to cut prices! If you're careful, you can find out what they're charging. Set your prices at about the same level. If they have been there for a while, they know what it takes. Above all, make friends with them; that can be handy as most shops swap parts at intervals.

### Credit

There's one thing to watch out for—credit! In all areas, there will be a few deadbeats that have already exhausted their credit with the other TV shops. When a new shop opens up, they flock to it thinking you don't know them yet. Put up a big sign "Cash On Delivery Only" and then stick to it. No reasonable customer will object to that. Cash is always good to have. It pays your bills on time, which is a nice thing to do, and makes your suppliers like you a lot.

Finally, thanks to a reader, Robert E. Taber, who's a Navy radio-man. He started all this by asking for advice on the subject! Several others have also asked the same question, so we hope that this will help them out. Good luck and much success to all of you just starting. **R-E**

### VCR REPAIRS

*continued from page 68*

The current applied to the brake coil is increased if rotational speed exceeds 1800 rpm, and vice versa, to maintain the scan speed at precisely 1800 rpm.

As shown in Fig. 11, the CTL control signal recorded on tape becomes the standard reference signal during playback. The CTL signal is compared with the 30 PG signal of the rotating heads, and any difference or error signal is amplified. Again, the amplifier output is used to control operation of the brake (and thus control speed of the rotating heads), so the heads trace the appropriate tracks, and playback is synchronized with record.

The system shown in Figs. 10 and 11 is a form of drum servo. There is also a capstan servo used in many VCR's. Most of the advanced servo systems used in present-day VCR's not only control speed, but also control the phase relationship between drum and capstan servos, producing even more precise synchronization.

Now that we have a basic understanding of how a VCR works, it is time to turn our attention to some more practical matters, such as the tools and procedures used in servicing those devices. We'll start by taking a look at the tools you need next time when we continue this article. **R-E**

## TOROIDAL Power Transformers



TYPE	SERIES No	SECONDARY Volts	RMS Current	TYPE	SERIES No	SECONDARY Volts	RMS Current
50VA 80 x 35 mm (3.1 x 1.4 in) 0.9 Kg (2.0 lbs) Regulation 13% \$19.95	2X010	6 + 6	4.16	225VA 110 x 45 mm (4.3 x 1.8 in) 2.2 Kg (4.9 lbs) Regulation 7% \$31.95	6X012	12 + 12	9.38
	2X011	9 + 9	2.77		6X013	15 + 15	7.50
	2X012	12 + 12	2.08		6X014	18 + 18	6.25
	2X013	15 + 15	1.66		6X015	22 + 22	5.11
	2X014	18 + 18	1.38		6X016	25 + 25	4.50
	2X015	22 + 22	1.13		6X017	30 + 30	3.75
	2X016	25 + 25	1.00		6X018	35 + 35	3.21
	2X017	30 + 30	0.83		6X019	40 + 40	2.81
	2X028	110	0.45		6X025	45 + 45	2.50
	2X029	220	0.22		6X033	50 + 50	2.25
80VA 90 x 30 mm (3.5 x 1.2 in) 1.2 Kg (2.6 lbs) Regulation 12% \$21.95	3X010	6 + 6	6.64	300VA 110 x 50 mm (4.3 x 2 in) 2.6 Kg (5.7 lbs) Regulation 4% \$35.95	7X013	15 + 15	10.00
	3X011	9 + 9	4.44		7X014	18 + 18	8.33
	3X012	12 + 12	3.33		7X015	22 + 22	6.82
	3X013	15 + 15	2.66		7X016	25 + 25	6.00
	3X014	18 + 18	2.22		7X017	30 + 30	5.00
	3X015	22 + 22	1.81		7X018	35 + 35	4.28
	3X016	25 + 25	1.60		7X026	40 + 40	3.75
	3X017	30 + 30	1.33		7X025	45 + 45	3.33
	3X028	110	0.72		7X033	50 + 50	3.00
	3X029	220	0.36	500VA 140 x 50 mm (5.5 x 2 in) 4 Kg (8.8 lbs) Regulation 4% \$47.95	8X016	25 + 25	10.00
120VA 90 x 40 mm (3.5 x 1.6 in) 1.2 Kg (2.6 lbs) Regulation 11% \$24.95	4X010	6 + 6	10.00		8X017	30 + 30	8.33
	4X011	9 + 9	6.66		8X018	35 + 35	7.14
	4X012	12 + 12	5.00		8X026	40 + 40	6.25
	4X013	15 + 15	4.00		8X025	45 + 45	5.55
	4X014	18 + 18	3.33		8X033	50 + 50	5.00
	4X015	22 + 22	2.72		8X042	55 + 55	4.54
	4X016	25 + 25	2.40		8X028	110	4.54
	4X017	30 + 30	2.00		8X029	220	2.77
	4X018	35 + 35	1.71		8X030	240	2.08
	4X028	110	1.09	625VA 140 x 75 mm (4.3 x 3 in) 5 Kg (11.0 lbs) Regulation 4% \$56.95	9X017	30 + 30	10.41
160VA 110 x 40 mm (4.3 x 1.6 in) 1.8 Kg (4.0 lbs) Regulation 8% \$27.95	4X029	220	0.54		9X018	35 + 35	8.92
	4X030	240	0.50		9X026	40 + 40	7.81
	5X011	9 + 9	8.89		9X025	45 + 45	6.94
	5X012	12 + 12	6.66		9X033	50 + 50	6.25
	5X013	15 + 15	5.33		9X042	55 + 55	5.68
	5X014	18 + 18	4.44		9X028	110	5.68
	5X015	22 + 22	3.63		9X029	220	2.84
	5X016	25 + 25	3.20		9X030	240	2.60
	5X017	30 + 30	2.66				
	5X018	35 + 35	2.28				

ILP toroidal transformers are half the weight and height of standard laminated transformers. Supplied with mounting kit. 5 year limited warranty. Trade and OEM enquiries welcome. Note: Regulation - all voltages quoted are full load. Add regulation figure to secondary voltage to obtain off load voltage.

CALL TOLL-FREE TO ORDER 800-833-8400

In New York call (716) 874-5510.

Mail orders accepted. VISA, Mastercard or checks.

**GLADSTONE** ELECTRONICS, INC.

1585 Kenmore Avenue Buffalo, New York 14217

In Canada: Gladstone Electronics, Toronto 800-268-3640

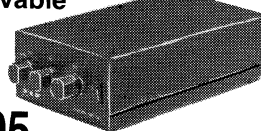
CIRCLE 71 ON FREE INFORMATION CARD

## AUDIO KITS STEREO PREAMPLIFIER

Unbelievable  
value  
at only

**\$69.95**

Model UC1



Compact stereo preamplifier demonstrating ILP's commitment to state-of-the-art performance at bargain prices! Simple-to-build kit features PRE-ASSEMBLED and TESTED module for complete assembly in a couple of hours, even with minimum previous experience. Features include inputs for magnetic cartridge, tuner, and tape with full monitor facilities: No tone controls ensure clearest possible performance: frequency response DC to 100kHz (to -3db), phono distortion 0.005%, signal-to-noise ratio 90db. The UC-1 draws its power from any ILP power amplifier; in other applications it requires an unregulated DC power supply voltage between  $\pm 15V$  and  $\pm 30V$  at 20ma (optional, extra \$27.90).

The ILP UC-1 is only one example of ILP's outstanding range of quality products including power amplifier kits, modules, and toroidal transformers. All carry a limited 5-year warranty. Available direct and at selected dealers. Write for details.

CALL TOLL-FREE TO ORDER 800-833-8400

In New York call (716) 874-5510

Mail orders accepted. VISA, Mastercard or checks.

**GLADSTONE** ELECTRONICS, INC.

1585 Kenmore Avenue Buffalo, New York 14217

In Canada: Gladstone Electronics, Toronto 800-268-3640

CIRCLE 73 ON FREE INFORMATION CARD



# STATE OF SOLID STATE

## High-voltage transistors

ROBERT F. SCOTT, SEMICONDUCTOR EDITOR

EVEN THOUGH WE ALL KNOW THAT HIGH-voltage transistors are available, many of us still think of the transistor as a low-voltage device. And we would be hard-pressed to draw a circuit illustrating a simple application of a high-voltage transistor. That's not true of STI (Semiconductor Technology Inc., (STI, 3131 S.E. Jay street, PO Box 474, Stuart, FL 33494), one of the industry leaders in high-voltage-transistor technology. They manufacture a broad line of silicon high-voltage types. The low- and high-power devices have ratings ranging from 30 mW to 200 watts and voltage ratings up to 2 kV  $V_{CBO}$  (collector-base breakdown voltage with open emitter). Many of those are direct replacements for discontinued types that were made by Delco and Texas Instruments.

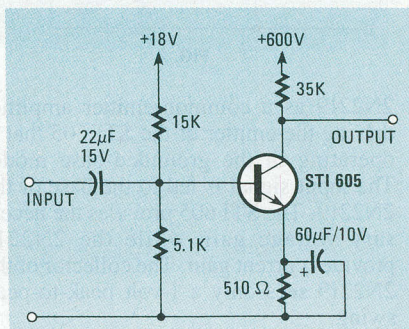


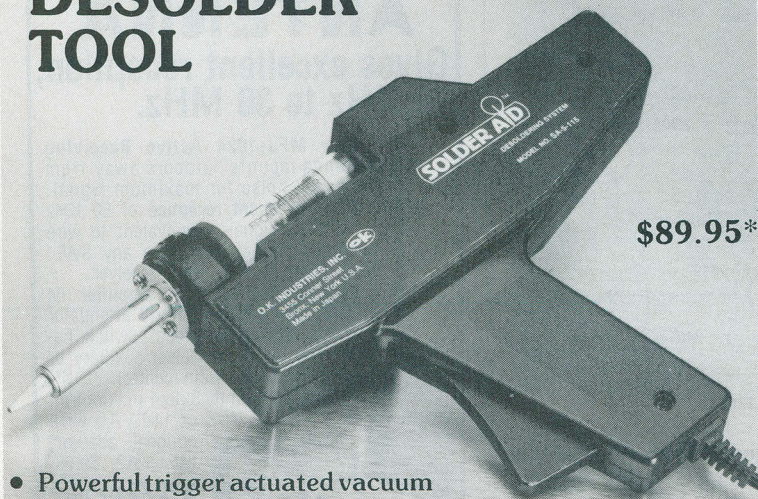
FIG. 1

The circuits in Figs. 1, 2, and 3 (from an STI application note) illustrate the development of a high-voltage wide-band deflection amplifier for the CRT in an oscilloscope. Figure 1 is the circuit of a basic Class-A amplifier. It has a low input

impedance and a voltage gain of over 300. A disadvantage of this circuit is that the Miller effect multiplies the collector-to-base or feedback capacitance by about the value of the gain. That very high effective input-capacitance loads the input circuit, reduces the high-frequency response, and increases the effective input-to-output coupling. The collector voltage is 300 volts with an idling or quiescent current of 10 mA, and the output voltage swing is 600 volts peak-to-peak.

Figure 2 shows how—through the addition of a low-voltage, high beta, NPN silicon transistor such as the 2N2219—we can improve performance by greatly minimizing the Miller effect and almost completely eliminating input circuit loading. The transistors are stacked in what is often called a cascode configuration with the

## THE NEW SA-5 DESOLDER TOOL



\$89.95\*

- Powerful trigger actuated vacuum pump.
- Clog-free straight suction path.
- Durable fast-rise ceramic heater.
- Specially processed long life tip.
- Transparent easily cleaned collector.
- Heavy duty – yet lightweight comfortable, and it's priced less, much less.

\*Does not include shipping charges and local taxes.

**dt DAVLE TECH INC**  
ELECTRONIC TOOLS & ACCESSORIES

2-05 BANTA PLACE  
FAIRLAWN, NJ, 07410  
TEL: 201-796-1720  
TELE: 968771

CIRCLE 54 ON FREE INFORMATION CARD

## Just in time for Christmas! The 16/8-bit H-100 Computer For that someone special!

Power-packed performance works to your advantage with our 16/8-bit H-100 Series Computers. The All-In-One model (shown here) or the sleek Low-Profile model will meet your computing needs now and in the future because of versatile expansion capabilities. Send for complete details today using the coupon below.



### FREE COLORFUL CATALOG

Please send me my FREE Heathkit Catalog featuring the H-100 Series Computers and many other quality electronic kits.

Name \_\_\_\_\_

Address \_\_\_\_\_ Apt. \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

MAIL TO: Heath Company, Dept. 020-123  
CL-768 Benton Harbor, MI 49022

**Heathkit®**  
Heath  
Company

CIRCLE 38 ON FREE INFORMATION CARD



## Versatile Lab Power Supply



**EXCEPTIONAL VALUE!** Only **\$125<sup>00</sup>**

- 0-30 VDC at 0-2A • Excellent Regulation
- Ripple & Noise - 500  $\mu$ V • Built-in Short-Circuit and Overload Protection

Model 3002A features continuously adjustable current limiting and precision constant voltage/constant current operation with "automatic crossover." This lab-grade unit can also be used as a current regulated power source.

Optional 10-turn voltage & current controls: \$25 each. Add \$3.00 for UPS shipping in Continental U.S. Check, Money Order or C.O.D. accepted. Illinois residents add 6% sales tax.



**ELECTRO INDUSTRIES, INC.**  
4201 W. IRVING PK., CHICAGO, IL 60641  
312/736-0999

CIRCLE 26 ON FREE INFORMATION CARD

# SAVE!

**MONEY • TIME • FREIGHT**

QUALITY STEREO EQUIPMENT AT LOWEST PRICES.

YOUR REQUEST FOR QUOTATION RETURNED SAME DAY.

FACTORY SEALED CARTONS—GUARANTEED AND INSURED.

SAVE ON NAME BRANDS LIKE:

PIONEER	JVC
KENWOOD	TEAC
MARANTZ	SANSUI
TECHNICS	SONY

**AND MORE THAN 50 OTHERS  
BUY THE MODERN WAY  
BY MAIL—FROM**

# illinois audio

BANK CARDS ACCEPTED  
12 East Delaware  
Chicago, Illinois 60611  
312-664-0020  
800-621-8042

CIRCLE 94 ON FREE INFORMATION CARD

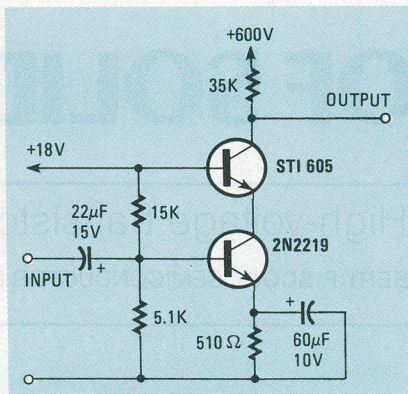


FIG. 2

2N2219 as a common-emitter amplifier driving the emitter of the STI 605 that is operating in the grounded-base mode. The input signal is fed to the base of the 2N2219. The STI 605 provides the necessary voltage gain while the 2N2219 provides current gain. The collector of the 2N2219 sees only a 1-volt peak-to-peak swing.

One of the advantages that is offered by this arrangement is that the STI 605 is operating under conditions that minimize the effects of beta changes and leakage currents, so the stability factor approaches one. That's accomplished by biasing the base of the STI 605 base with a constant voltage while emitter is biased by the 2N2219, which acts as a constant-current source.

Figure 3 shows how two stages of the

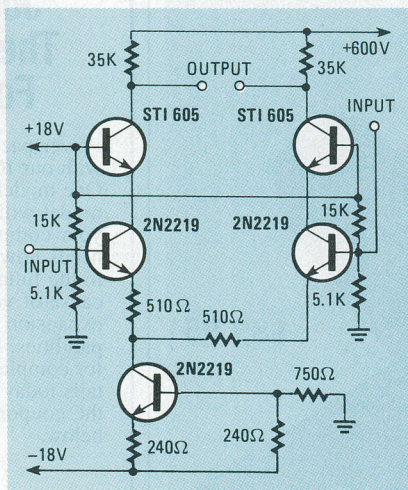


FIG. 3

circuit just described can be arranged as a differential amplifier delivering approximately 1200 volts peak-to-peak. The circuit can be used as a wide-band deflection amplifier in a scope. The third 2N2219 is a constant-current source for the differential amplifier.

Taking a quick look at the characteristics of the STI 605, we see that its power dissipation at 25°C is 2 watts;  $V_{CBO}$  is 600 volts;  $I_{CBO}$  (the collector-base cutoff current) at 450 volts is 4  $\mu$ A;  $h_{FE}$  (the DC current gain in the common-emitter configuration) at  $I_C = 25$  mA is 30; and

## CABLE TV

### CONVERTERS DESCRAMBLERS

**Largest Selection  
of Equipment Available**  
\$ Buy Warehouse Direct & Save \$



**36 channel  
converter  
\$45<sup>95</sup>**

**36 channel  
wired remote  
converter  
only  
\$88<sup>95</sup>**



*Send \$2 for complete catalog  
of converters and unscramblers*

Quantity Discounts • Visa • Master Charge  
Add 5% shipping—Mich. residents add 4% sales tax

**C&D Electronics, Inc.**  
P.O. Box 21, Jenison, MI 49428  
(616) 669-2440

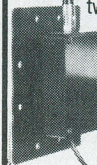
## ACTIVE RECEIVING ANTENNA

**Gives excellent reception,  
50 KHz to 30 MHz.**

**New MFJ-1024 Active Receiving Antenna** mounts outdoors away from electrical noise for maximum signal.

**Gives excellent reception of 50 KHz to 30 MHz signals.** Equivalent to wire hundreds of feet long. Use any SWL, MW, BCB, VLF or Ham receiver.

**High dynamic range RF amplifier.** 54 in. whip. 50 foot coax. 20 dB attenuator prevents receiver overload. Switch between two receivers. Select auxiliary or active antenna. Gain control. "ON" LED. Remote unit, 3x2x4 in. Control, 6x2x5 in. 12 VDC or 110 VAC with optional adapter, MFJ-1312, \$9.95.



**\$129<sup>95</sup>**  
(+ \$4.00 shipping)

**Order from MFJ and try it.** If not delighted, return within 30 days for refund (less shipping). **One year unconditional guarantee.**

**Order today. Call TOLL FREE 800-647-1800.** Charge VISA, MC. Or mail check, money order. **Write for free catalog.** Over 100 products.

**CALL TOLL FREE 800-647-1800**

Call 601-323-5869 in Miss., outside continental USA, tech/order/repair info. TELEX 53-4590.

**MFJ ENTERPRISES, INCORPORATED**

Box 494, Mississippi State, MS 39762

CIRCLE 66 ON FREE INFORMATION CARD



# UNGAR DESOLDERING & SOLDERING

## Special Pricing... Special Free Offer

### Hot VAC Desoldering System



Model 4000

Built-in vacuum pump eliminates the need for shop air. Compact design and portability make it ideal for use at any location where there is an AC electrical plug-in outlet.  
**Self-Contained, Super-Quiet Air Pump:** The vacuum pump is not only virtually maintenance free, it is remarkably quiet. The pump operates only when the handle switch is actuated.  
**Temperature Control:** Variable solid-state control that adjusts the tip temperature from 500° - 1000° F. An electric circuit assures that transient spikes are fully suppressed thereby making the system safe for desoldering voltage-sensitive components.

Reg \$599.95  
**OUR SPECIAL PRICE**

**\$379<sup>95</sup>**

### Electronic Temperature Controlled Soldering System with Built-in Controller



Model 9100

**OUR SPECIAL PRICE \$89<sup>95</sup>**

**FREE** UNGAR 9100  
 with purchase of  
 Ungar 4000

Includes: base unit with built-in controller, micro-size handle with THERMO-DURIC heater, 1/16" #9012 screwdriver tip, sponge and tip tray, sponge, and Iron Holder. A low cost alternative in an operator-adjustable, temperature controlled soldering system.  
 • Electronic, closed-loop temperature control for maximum precision • Temperature is operator-adjustable from 400° F to 800° F • Continuous, variable control so you can select the exact temperature you need • Neon "on-off" light • Iron Holder can be right- or left-hand mounted to accommodate all operators.

TOLL FREE (800) 645-9518

**FORDHAM**



260 Motor Parkway, Hauppauge, N.Y. 11788

in N.Y. State 800-832-1446

■ VISA ■ COD ■ Master Charge  
 ■ Money Order N.Y. State residents add  
 ■ Check appropriate sales tax.  
 COD's extra (required 25% deposit)

ADD FOR SHIPPING AND INSURANCE

\$250.00	....	\$4.50
\$251.00 to 500.00	.....	6.50
501.00 to 750.00	....	8.50
751.00 to 1000.00	....	12.50
over 1000.00	.....	15.00

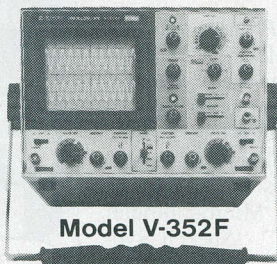
# FORDHAM DISCOUNTS DISCOUNT PRICES ON HITACHI SCOPES

**SPECIAL OFFER!**  
*For a limited time only*

### 35 MHz DUAL TRACE SIGNAL DELAY LINE

Vertical sensitivity 5m V/div to 5V/div and 1m V/div to 1 V/div with 5X amplifier • Trigger modes Auto-matic, Normal, TV (+), TV(-).

REG \$895  
**OUR PRICE**  
**\$599<sup>95</sup>**  
 WITH PROBES

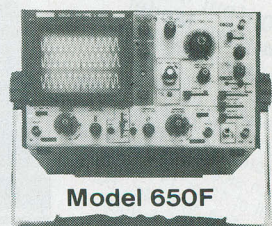


Model V-352F

### 60 MHz DUAL TRACE DELAYED SWEEP

High sensitivity • 1 mV/div (10 MHz) • 5 ns/div sweep rate  
 • 3rd channel display (trigger view) • Variable trigger hold-off  
 • Full TV triggering • Single sweep • Auto-matic focus correction.

**OUR PRICE**  
**\$995**  
 WITH PROBES

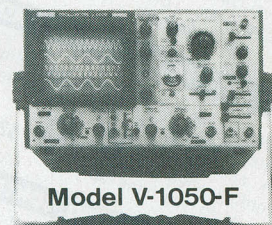


Model 650F

### 100 MHz QUAD TRACE DELAYED SWEEP

Large, bright 8x10 cm screen  
 • Quad trace operation/Ch1, Ch2, A trigger and B trigger • High sensitivity 500 µ V/div (5 MHz)  
 • Full TV triggering.

**OUR PRICE**  
**\$1590**  
 WITH PROBES



Model V-1050-F

TOLL FREE (800) 645-9518

**FORDHAM**



260 Motor Parkway, Hauppauge, N.Y. 11788

in N.Y. State 800-832-1446

■ VISA ■ COD ■ Master Charge  
 ■ Money Order N.Y. State residents add  
 ■ Check appropriate sales tax.  
 COD's extra (required 25% deposit)

ADD FOR SHIPPING AND INSURANCE

\$250.00	....	\$4.50
\$251.00 to 500.00	.....	6.50
501.00 to 750.00	....	8.50
751.00 to 1000.00	....	12.50
over 1000.00	.....	15.00



# If you need QUARTZ CRYSTALS —one or hundreds— YOU NEED JAN

- high stability
- prompt service
- cost savings

**JAN**  
CRYSTALS

- General Communication
- Industry
- Marine VHF
- Scanners
- Amateur Bands
- CB Standard
- CB Special
- Microprocessor

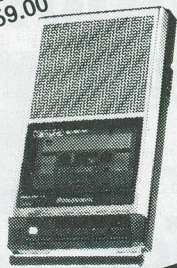
Call or write  
**JAN CRYSTALS**  
P.O. Box 06017  
Ft. Myers, FL 33906-6017  
All phones (813) 936-2397

CIRCLE 28 ON FREE INFORMATION CARD

## SUPER LONG PLAY TAPE RECORDERS

10 Hour Model — \$95.00\*  
14 Hour Model — \$159.00\*

Modified Panasonic Slimline. high quality. AC-DC Recorders provide 5 or 7 continuous hours of quality recording & playback on each side of cassette for a total of 10 or 14 hours depending on model. Built-in features include • Voice level control, • Digital counter, etc. TDK DC 180 Cassette Furnished.



### PHONE RECORDING ADAPTER

Records calls automatically. All Solid state connects to your telephone jack and tape recorder. Starts recording when phone is lifted. Stops when you hang up. **\$24.50\*** FCC APPROVED

**VOX VOICE ACTIVATED CONTROL SWITCH**  
Solid state. Self contained. Adjustable sensitivity. Voices or other sounds automatically activate and control recorder. Uses either recorder or remote mike. **\$24.95\***

\*Add for ship & hdlg. Phone Adapter & Vox \$1.50 ea. Recorders \$4.00 ea. Cal. Res. add tax. Mail order, VISA, M/C, COD's OK. Money Back Guarantee. Qty. disc. avail. Dealer inquiries invited. Free data. ©  
**AMC SALES INC.** Dept. 9335 Lubec St., Box 928, Downey, CA (213) 90421 Phone 869-8519

CIRCLE 67 ON FREE INFORMATION CARD

$V_{CEsat}$  (the collector-emitter saturation voltage) when  $I_C = 25$  mA is 1.5 volts.

### DRAM control application manual

A 42-page booklet, *TMS4500 Dynamic RAM Controller User's Manual* (SCG690A) describes the operation of the Texas Instruments TMS4500 dynamic memory controller and illustrates its applications in a microprocessor system. The device provides address multiplexing, cycle timing, and refreshing for DRAM's (Dynamic Random-Access Memories). Chapter headings are "Functional Description," "Typical Implementation," "Design Criteria," and "Application Examples." The last chapter discusses uses of the TMS4500A with the 8085A, Z80, TMS-9900, MC68000, 8086, Z8001, and TMS-9995 microprocessors. It's a handy guide if you are designing or updating a small computer or microprocessor-based equipment. — **Texas Instruments**, PO Box 3640, Dallas, TX 75285.

### BiFET op-amp

The AD547 is a monolithic, FET-input op-amp from Analog Devices. It offers the low-input-bias-current (typically 25 pA) advantage of the BiFET with the low-offset-voltage and low-drift characteristics usually associated with high-quality bipolar devices. Input offset voltage and offset-voltage drift are 1 mV,  $\pm 5 \mu V/^\circ C$  for the AD547J; 0.5 mV,  $\pm 2 \mu V/^\circ C$  for the -K; 0.5 mV,  $\pm 1 \mu V/^\circ C$  for the -L, and 0.5 mV,  $\pm 5 \mu V/^\circ C$  for devices with the SH suffix.

The low noise, high open-loop gain, and outstanding offset performance make the AD547 ideal for use as a precision instrumentation amplifier for signal conditioning and analog computations. The device is available in three commercial grades. The J, K, and L grades operate in the  $0^\circ$  to  $+70^\circ C$  range. The SH grade (military version) operates from  $-55^\circ C$  to  $+125^\circ C$ . All grades are in TO-99 hermetically sealed cans. — **Analog Devices**, PO Box 280, Norwood, MA 02062.

### Dedicated IC catalog

*Microelectronics Product Guide* assists the reader in selecting the dedicated IC best suited to his needs. Devices are catalogued according to category under such headings as "ROM's," "Keyboard Encoders," "Character Generators," "EEPROM's/EAROM's," "Microcomputers and Microcomputer Development Systems," "Speech Synthesis," "TV Games," and "Radio and TV Control." Devices in each category are listed in a tabular form. In addition to part numbers, there are column headings for function, description, package type, supply voltage, and special features. — **General Instrument**, Microelectronics

continued on page 110

SEE YOUR DEALER TODAY

FROM

**'Firestik'®**  
ANTENNAS  
ACCESSORIES

HERE'S A TIP  
THAT'S PERFECT!

AM/FM AUTO RADIO  
AND CB

**'Firestik'® II**  
GOLDEN SERIES

BARE-HANDS TUNABLE  
"NO TOOLS NEEDED"  
HIGH PERFORMANCE ANTENNAS

ALSO ANTENNAS FOR  
CORDLESS TELEPHONES  
MONITOR SCANNERS

Dealer & Distributor Inquiries Invited  
SEND FOR FREE CATALOG

'Firestik' Antenna Company

2614 East Adams/Phoenix, AZ 85034

Name \_\_\_\_\_  
Street \_\_\_\_\_  
City \_\_\_\_\_  
State \_\_\_\_\_ Zip \_\_\_\_\_

Serving the CB and  
Communications Market Since 1962.

**5-YEAR REPLACEMENT WARRANTY**

CIRCLE 40 ON FREE INFORMATION CARD

## YOUR EXCITING NEW HOBBY!

- Enjoy fantastic savings by assembling your own organ or piano.
- It's easy. No technical knowledge required.
- Just follow our clear, pictured instructions.
- Choose from many models from portables to consoles.
- Ask about our interest free installment plan.

**WERSI**

**ORGAN & PIANO KITS**

For Free Information Pack M40

Call Toll Free

800-233-3865

In PA 717-299-4327

or send  
coupon  
below



WERSI Dept. M40 P.O. Box 5318  
Lancaster, PA 17601

☐ Free Info. Pack: ☐ Organ ☐ Piano  
☐ Catalog & Demo Record (enclose \$6)

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
Phone (\_\_\_\_\_) \_\_\_\_\_

Rep inquiries invited

CIRCLE 100 ON FREE INFORMATION CARD



# Clean up the computer clutter.

**For less than \$250  
you can make your  
investment in yourself  
pay off!**

Chances are you have spent a couple thousand dollars on setting up a computer system that gets a lot of your work done. But sometimes it gets to be work to work at it.

I know that when I have to move two program manuals and a pencil holder to boot up the disk drive, it is work. When there is an unlabeled floppy (that I am going to identify some day) on top of the monitor and the business check-book is on top of the printer . . . and I will remember (I hope) before the next "report" comes through . . . that is work.

I found the annoyance of my own "computer clutter" was even worse than the extra work the disorder created. And that is when I started looking for some practical furniture for my computer set up. Since I had already spent a lot of money on the system itself, I was really dismayed when I found out how much it would cost to get a decent-looking desk or even a data table for my equipment. \$400 . . . \$500 . . . even more for a sleazy unit that looked like junk! In fact, it was junk! And it took a long time for me to find something that was really worth the money . . . and more.

A lot of my working day is spent with my computer, and I will bet a lot of your time is too. So I figure a "home" for my system—a housing that is good looking as well as efficient to work at—will pay off two ways:

1. Less work: an efficient and orderly layout will save me time and energy.
2. Personal satisfaction: good quality furnishings look better; they just plain feel better to work at too.

So imagine how good I felt to find the "Micro-Office" Work Center! These are fine pieces of computer system furniture that make my office-at-home as pleasant a place to work as it ought to be. And the



**only \$249.50**

## MICRO-OFFICE WORK CENTER

biggest and best surprise is the low, low price for such good quality.

Here is what you get—all for only \$249.50 plus shipping.

- Mar-resistant work surface. Your choice of oak or walnut grained. Work surface height is adjustable to your keyboard, your chair, your height.
- Two shelves plus work surface extender. Both shelves tilt to lock in position so that monitor faces you—in a position that does away with screen glare squinting and neck craning forever. Retainer bar keeps equipment from sliding off shelf. Snap-in bookends hold reference manuals and programs.
- Strong, sturdy and steady. All-steel welded frame construction is concealed by top-quality wood grain surfaces with finished trim. Adjustable floor levelers included. The work center is really a piece of fine furniture.
- There is no risk in buying from us either. We will make a full refund of purchase

price plus shipping charges if you return the workcenter within 30 days for any reason whatsoever. In addition, the product is warranted for any defects in materials or construction for a full year from date of purchase. This is a no-risk investment in your own productivity and work efficiency that will pay off for years to come—even if you do not yet have a microcomputer of your own.

- Take your choice for your own work center decor:

Order 48-inch unit in walnut, #2KPO-945, or in oak, #2KPO-947. Only \$249.50 for each unit plus \$20.00 shipping charge. On orders for two or more units at the same time, shipping charge applies to only the first unit ordered. Shipment made UPS, so we cannot ship to post office box. Illinois residents please add \$15 per unit sales tax. Please allow 10 extra days for personal checks to clear. Sorry—at these special offer prices we cannot ship c.o.d. or bill direct.

**CALL TOLL FREE TODAY WHILE SUPPLIES LAST: 1-800/323-8064.**

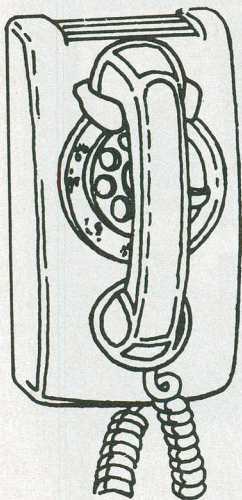
**In Illinois call 1-312/251-5699. Or mail check with order to:**

### Micro-Mart Distributors

Dept. RE-12 • 1131 Central Street • Wilmette, IL 60091



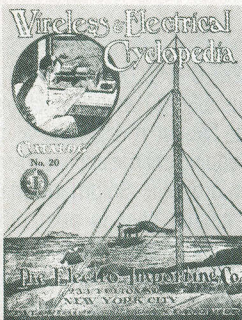
# Radio-Electronics mini-ADS



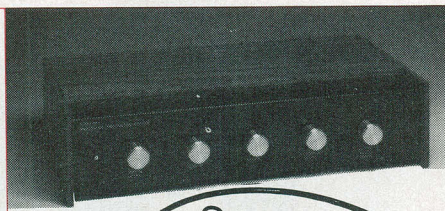
## CALL NOW AND RESERVE YOUR SPACE

- 6 x rate \$605 per each insertion.
- Reaches 235,323 readers.
- Fast reader service cycle.
- Short lead time for the placement of ads.
- We typeset and layout the ad at no additional charge.

Call **212-777-6400** to reserve space. Ask for Arline Fishman. Limited number of pages available. Mail materials to: mini-ADS, RADIO-ELECTRONICS, 200 Park Ave. South, New York, NY 10003.



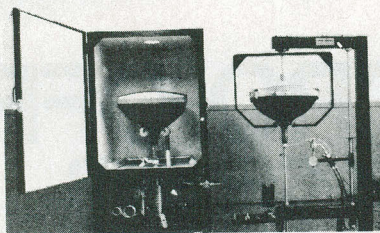
**WIRELESS & ELECTRICAL CYCLOPEDIA.** Originally printed in 1918, this 176-page reprint of the complete catalog gives you an accurate look at the state of electronics in 1918. Contains everything from a Zinc Spark Gap to a 1000-Mile Receiving Outfit. You can get your own copy of this modern antique, profusely illustrated, for only **\$4.95** plus \$1.00 P&H. Order yours from **R-E BOOKSTORE, Radio-Electronics, 200 Park Avenue, South, New York, NY 10003.**



**SAVE \$50  
Now Only  
\$99.95**

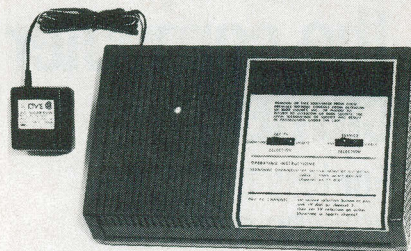
**AUDIO DELAY LINE.** Make your listening room sound like a concert hall. The AAS-911 adds the effect of special dimension to your sounds; that big real life feeling. Featured in R.E. (Sept./Oct. 81) AAS-911 kit only **\$99.95.** (VISA, M/C welcome—**Advanced Analog Systems Inc., 790 Lucerne Dr., Sunnyvale, CA 94086 (408) 730-9786.**

CIRCLE 19 ON FREE INFORMATION CARD



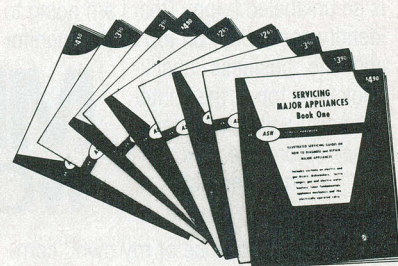
**ONE MAN CRT FACTORY,** easy operation. Process new or rebuild old CRT's for tv's, bus. machines, monitors, scopes, etc. Color, b&w, 20mm, foreign or domestic. 3x6 ft. space required. Profits??? Average CRT rebuilding cost — \$5. Sell for \$100 = \$95 profit; x 5 CRT's = \$475 daily; x 5 days = \$2375 weekly profit. Higher profits outside U.S.A. Investigate this opportunity today. We service the entire world. Write or call: **CRT Factory, 1909 Louise St., Crystal Lake, IL 60014, (815) 459-0666.**

CIRCLE 84 ON FREE INFORMATION CARD



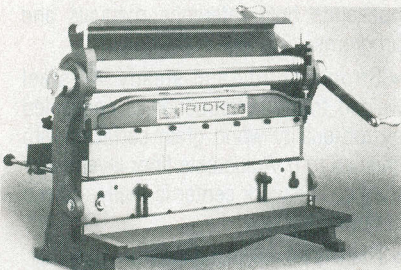
**DESCRAMBLERS** Completely assembled and tested. Compatible with ZENITH Z-TAC and SSAVI systems. No internal T.V. connections. Built in **VARIATOR TUNER. \$129.00** VISA, M/C, and C.O.D. orders accepted. **DE-CODER DISTRIBUTORS CO., 23400 Michigan Avenue, Suite 502, Dearborn Michigan, MI 48124 (313) 562 • 9661.** Other models available, we also ship to Canada.

CIRCLE 92 ON FREE INFORMATION CARD

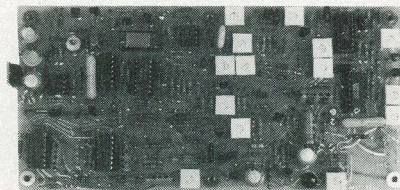


**APPLIANCE REPAIR HANDBOOKS—13** volumes by service experts; easy-to-understand diagrams, illustrations. For major appliances (air conditioners, refrigerators, washers, dryers, microwaves, etc.), elec. housewares, personal-care appliances. Basics of solid state, setting up shop, test instruments. **\$2.65 to \$5.90 each.** Free brochure. **APPLIANCE SERVICE, PO Box 789, Lombard, IL 60148. 1-(312) 932-9550.**

CIRCLE 21 ON FREE INFORMATION CARD



**SHEET METAL WORKER - The 24" TRIOK** is a Press Brake, Shear and Slip-roll machine—perfect for research and development or maintenance shops. Over a thousand machines world wide in little to the largest companies. For free literature on this and our other sheet metal working machines contact: **PACIFIC ONE CORPORATION, 513 Superior Ave. Suite K351 Newport Beach, CA 92663, (714) 645-5962.**



High precision **NTSC I and Q** color bar generator board. Vectors accurate to 1 degree, amplitudes to 1%. All pulses derived from 14.318180 TXCO. Guaranteed for 1 year. Measures  $7\frac{3}{4} \times 3\frac{3}{4}$ , requires + and -12 volts to produce 1 volt of video in 75 Ohms. Price **\$198.50** (Costs \$125.) Add \$4.50 for insurance. Checks, money orders and C.O.D. only. Other NTSC boards available. Satisfaction guaranteed. **MULTIDYNE ELECTRONICS, P.O. Box 528, Locust Valley, N.Y. 11560. (516) 671-7278.**

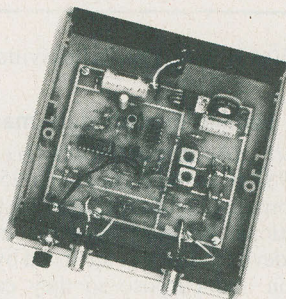
CIRCLE 69 ON FREE INFORMATION CARD.



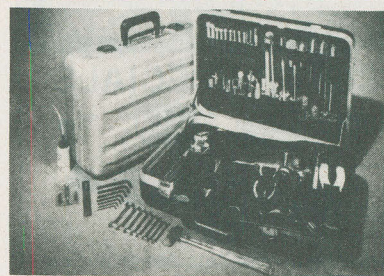
## CALL NOW AND RESERVE YOUR SPACE

- 6 x rate \$605 per each insertion.
- Reaches 235,323 readers.
- Fast reader service cycle.
- Short lead time for the placement of ads.
- We typeset and layout the ad at no additional charge.

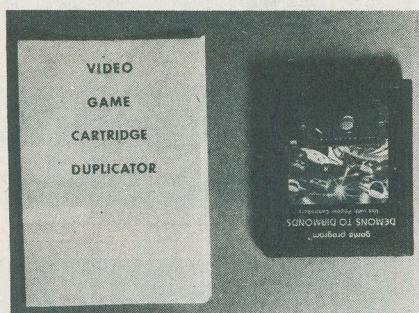
Call 212-777-6400 to reserve space. Ask for Arline Fishman. Limited number of pages available. Mail materials to: mini-ADS, RADIO-ELECTRONICS, 200 Park Ave. South, New York, NY 10003.



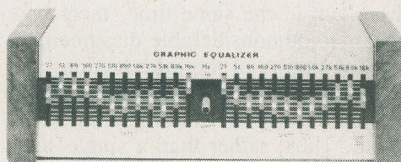
**CABLE TV DESCRAMBLER KIT \$39.95**  
Computerized addressable gated sync type. We also have complete line of Jerrold and Oak cable TV converters and descramblers. Such as, Jerrold gated sync (SB-3), Oak sinewave (N12), and Jerrold 61 channel remote control converter descrambler (DRX-DIC-105). 90 day warranty. **SEND \$2.00** for "INFORMATIVE CATALOG" for prices and availability to: **J & W ELECTRONICS, INC., P.O. Box 61-X, Cumberland, RI 02864.**  
**CIRCLE 63 ON FREE INFORMATION CARD**



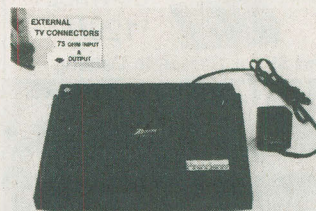
**117 PIECE PROFESSIONAL TOOL KIT -**  
This kit is just one of over 50 new tool kits shown in Contact East's new, FREE, 1984 catalog. Catalog is packed with over 5,000 precision tools, test instruments, soldering supplies and hard-to-find technical products for assembling, testing and repairing electronic equipment. Complete with color photographs, detailed descriptions and pricing. Order by phone or mail. 24 hour shipment. 100% satisfaction guaranteed. **CONTACT EAST, INC. PO Box 160, Burlington, MA. 01803 (617) 272-5051.**  
**CIRCLE 24 ON FREE INFORMATION CARD**



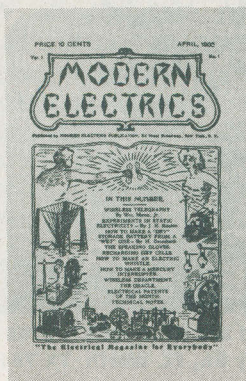
**BACKUP YOUR ATARI® CARTRIDGES.**  
Video game cartridges are easily destroyed. You can protect your investment by making archival backup copies of your 2600 series game cartridges. Most cartridges are easily copied onto 2732 EPROM's. Build our EPROM duplicator for **under \$45**, make cartridge copies for **under \$10**. Complete detailed plans **only \$10.95. RANDOM ACCESS, Box 41770R, Phoenix, AZ 85080.**  
**CIRCLE 57 ON FREE INFORMATION CARD**



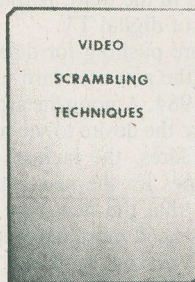
**STILL THE BEST GRAPHIC EQUALIZER KIT** \*See Radio-Electronics 5/78 cover story \*12 bands/channel - \*.02% distortion - \*92dB S/N ratio - \*Solid walnut ends - \*Price reduced: **\$89.00** postpaid M/C, Visa add shipping: **Free catalog. SYMMETRIC SOUND SYSTEMS, 856J Lynn Rose Ct., Santa Rosa, CA 95404.**



**SURPLUS ZENITH SSAVI TV DESCRAMBLER** - This is the real McCoy manufactured by Zenith and used by VHF Station operators in: Ann Arbor Ch 31, Baltimore Ch 54, Chicago Ch 66, Dallas Ch 27, Minneapolis St. Paul Ch 23, San Jose Ch 48, St. Louis Ch 30, Tulsa Ch 41, Washington Ch 50, Boston Ch 27. *This unit delivers picture & sound out of TV, no internal connections.* Complete with power adaptor (24 & 12 volt dual). Insured shipping direct to you. *To order:* send only U.S. Postal Money Orders **\$189.00. VIDEO ELECTRONICS, 3083 Forest Glade Dr. Windsor, Ontario N8R-1W6. Quantity Orders (519) 944-6443.**  
**CIRCLE 89 ON FREE INFORMATION CARD**

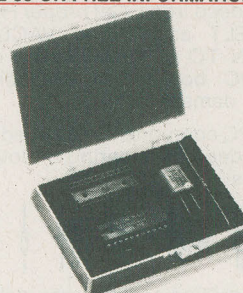


**MODERN ELECTRICS.** Miniature souvenir of the first publication ever produced by Gernsback Publications. This issue appeared in April 1908—just 75 years ago. You can own your own reprint of this unique first edition for just **\$2.50** plus 75c P&H. It's available from **R-E BOOKSTORE, Radio-Electronics, 200 Park Avenue South, New York, NY 10003**



**SUBSCRIPTION TV MANUAL.** This information packed book details the methods used by subscription TV companies to scramble and descramble video signals. Covers the sinewave, gated pulse, SSAVI system, and the methods used by most cable companies. Includes circuit schematics, theory, waveforms and trouble shooting hints. **Only \$12.95** plus **\$1.50** first class shipping and handling. **RANDOM ACCESS, Box 41770R, Phoenix, AZ 85080.**

**CIRCLE 17 ON FREE INFORMATION CARD**



**TELONE'S TRK-957 KIT** makes it easier and less expensive to breadboard a low-power, central office quality DTMF detection system. The included M-957 DTMF Receiver decodes 12 or 16 digits and operates from 5 to 12V dc. The sensitivity, wide dynamic range, noise immunity, and low-power consumption make it ideal for telephone switching, computer and remote control applications. The TRK-957 DTMF Kit is only **\$24.75**. **To order call: 1-800-227-3800, ext. 1130.**

**TELONE:**

**CIRCLE 108 ON FREE INFORMATION CARD**



# CABLE TV

Buy Direct & Save

## SUPER SPECIALS



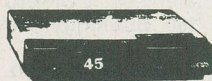
40 CHANNEL  
CONVERTER  
\$29<sup>95</sup>

Advanced Solid State design and circuitry allows you to receive mid & super band channels. Restores programming to Video Recorders.



36 CHANNEL  
REMOTE CONTROL  
CABLE CONVERTER  
\$69<sup>95</sup>

JERROLD 400  
THE ULTIMATE CABLE TV  
CONVERTER



60 CHANNEL  
INFRARED  
REMOTE  
CONTROL  
\$129<sup>95</sup>

Send \$5 for Complete Catalog

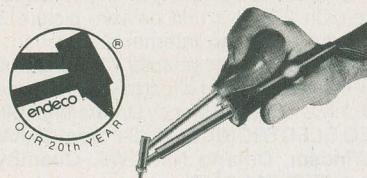
**DIRECT VIDEO SALES**

P.O. BOX 1329  
JEFFERSONVILLE, INDIANA 47130

CALL  
1-812-282-4766

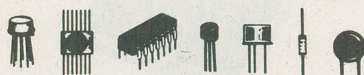
CIRCLE 53 ON FREE INFORMATION CARD

## Vital protection for PC Boards



Be safe. Desolder PC components with Endeco irons. Get proper HEAT TO MELT and strong VACUUM ACTION TO LIFT solder and cool both PC board and component without damage.

These PC components replaced fast with Endeco desoldering or soldering tools.



Endeco professional features include safety light that denotes high, low and off on switch models, SS construction for long life, light weight and balance for easy use.

Contact your distributor for Endeco desoldering and soldering irons, kits and equipment—or write us today.

**Enterprise Development Corp.**

5127 East 65th Street  
Indianapolis, IN 46220  
Phone: (317) 251-1231

CIRCLE 42 ON FREE INFORMATION CARD

## STATE OF SOLID STATE

continued from page 106

Div., 600 W. John St., Hicksville, NY 11802

### Power semiconductor data manual

*Semiconductor Product Digest—1982-1983* (Catalog SPD-1) is a 25-page short-form listing of the characteristics of International Rectifier's power semiconductor devices. Devices are listed by construction and purpose so they can be quickly located. Groupings include **HEX-FET** Power MOSFET's, Power Schottky Rectifiers, Bipolar Power Transistors and Darlington's, Thyristors; General-Purpose, Fast-Recovery, and High-Voltage Silicon Rectifiers; Diode Bridges, Protective Devices, and Opto-electronic Devices. An alphanumeric listing greatly simplifies finding the location of a particular device in the manual.—**International Rectifier**, 233 Kansas St., El Segundo, CA 90245. **R-E**

## PORTABLE VIDEO

continued from page 74

the system at the same time, there now appears to be considerable disagreement as to the timing of the introduction, and some even want to go back to the drawing board to develop an even more advanced system. Thus, rather than a single standard, we could yet wind up with two incompatible 8-mm formats, or perhaps none at all.

We've already touched upon one major area of disagreement—the method of video recording. Several manufacturers want to bring everything back into committee and develop a standard based on something similar to Thomson's "Timeplex" baseband proposal. There has even been feeling that everything should be put on hold to await further advancements or developments in the field, perhaps even for the advent of digital TV.

Others are pushing for delaying introduction of the new standard until at least the end of 1984. Among the arguments for the delay are the desire to see how the new *Betamovie* fares, the lack of a ready library of tapes for the new standard, and the feeling that the new tape heads and metal tapes need more development.

The real reason, however, might be some manufacturer's fears of what the new standard could do to their existing 1/2-inch business. If the system lives up to the high expectations many have for it, extended play-time cassettes and home machines are sure to follow, making 8-mm video a home as well as portable standard. If that happens, it could relegate both VHS and Beta to the scrap heap before very long. In any event, it appears that the future of 8-mm video may depend more on politics than on any other factor. **R-E**

NEW



## GUITAR CHORD COMPUTER

Quick. Think of 3 ways to play a D flat 9th chord. Give up? The **GUITAR CHORD COMPUTER** shows you all three in less than 10 seconds. Virtually every guitar player can use one of these. Here's what it will do: **CHORDS** Major, Minor, Dominant, Augmented, and Diminished; **SCALES** Major, Harmonic Minor, Melodic Ascending, and Melodic Descending; **ALTERNATES/INVERSIONS** 3 and 4 alternates are shown for most chords (Easiest to play is displayed first); **TRANSPOSE** Up or down by half-steps; **6th, 7th, 9th CHORDS** Displayed at the touch of a button. Play better and easier guitar in minutes. Order yours today! **No. CC-2 Guitar Chord Computer** \$59.95 (plus \$2.50 postage & handling)

CHARGE TO VISA OR MC TOLL-FREE  
1-800-654-8657 9AM to 5PM CST MON-FRI

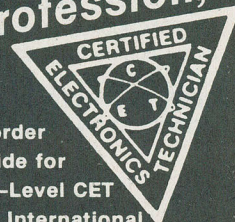
Ask for your free catalog.  
Direct mail orders and inquiries to: Dept. 12R

**PAIA Electronics, Inc.**  
1020 W. Wilshire, Oklahoma City, OK 73116 • (405) 843-9626

CIRCLE 52 ON FREE INFORMATION CARD

## TECHNICIANS,

Get serious about your profession;



Now you can order the "Study Guide for the Associate—Level CET Test" from the International Society of Certified Electronics Technicians. It includes material covering the most often missed questions on the Associate CET Exam. 8 1/2" x 11", paperback, 80 pages.

**GET CERTIFIED!**

Send check to ISCET, 2708 W. Berry St., Ft. Worth, TX 76109.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

\_\_\_\_\_ copies @ \$5.00 ea.

Send material about ISCET and becoming certified.



# MARKET CENTER

## FOR SALE

**CABLE TV** products Jerrold, Hamlin, and Oak converters. Send \$2.00 for information. **ADDITIONAL OUTLET CORP.**, 111 E. Commercial Blvd., Ft. Lauderdale, FL 33334.

**CABLE TV SECRETS**—the outlaw publication the cable companies tried to ban. HBO, Movie Channel, Showtime, descramblers, converters, etc. Suppliers list included. Send \$8.95 to **CABLE FACTS**, Box 711-R, Pataskala, OH 43062.

**RESISTORS** 1/4&1/2W5% C.F. 3 cents. 1%M.F. All values. **No minimums.** Volume discounts. Write **JR INDUSTRIES**, 5834-B Swancreek, Toledo, OH 43614.

**COLOR** computer VIC-20 programs hardware Rtty code EPROM Programmer RS-232 **FRANK LYMAN**, Box 3091, Nashua, NH 03061.

**PRINTED-circuit boards:** single side, prototype, and quantity, quick delivery. Send positive, free quotes. **FABTRON**, Box 925, Dept. C, Columbia, TN 38401 (615) 381-1143.

**RADIO West**—still the best for SW/MW DX receivers and receiver modifications! Catalog 50 cents. **RADIO WEST**, 3417 Purer Road, Dept RE, Escondido, CA 92025 (619) 741-2891.

**SCANNER**/monitor accessories—kits and factory assembled. Free catalog. **CAPRI ELECTRONICS**, Route 1R, Canon, GA 30520.

**RECORDS**—tapes! Discounts to 73%; all labels; no purchase obligations; newsletter; discount dividend certificates; 100% guarantees. Free details. **DISCOUNT MUSIC CLUB**, 650 Main Street, PO Box 2000, Dept. 3-1283, New Rochelle, NY 10801.

**TI-99/4A** software. Free price list plus newsletter. **GLEN DOBBS**, Box 801 RE, Santa Maria, CA 93456.

**ELECTRONIC Surveillance!** Incredible manual, "Homebrew Bugging" reveals secret techniques used by professionals (schematics included)—\$15.00. Send \$3.00 for our catalog. **A.T.I.S.**, Dept. R, 61 Gatchell St., Buffalo, NY 14212.

**PRINTED-circuit boards** and components per published projects. **GEMINI PROJECTS**, PO Box 8882, St. Petersburg, FL 33738 or (312) 456-4709.

**SATELLITE**—microwave—cable—video equipment. Systems from \$75.00. Send SASE to **H.M.S.**, 2011w. 11th St., Upland, CA 91786.


**WRITE FOR**  
**McGEE'S**  
**SPEAKER & ELECTRONICS CATALOG**  
**1001 BARGAINS IN SPEAKERS**  
**Tel.: 1 (816) 842 5092**  
**1901 MCGEE STREET KANSAS CITY, MO. 64108**

To run your own classified ad, put one word on each of the lines below and send this form along with your check for \$1.90 per word (minimum 15 words) to:  
**Radio-Electronics, 200 Park Avenue South, N.Y., N.Y. 10003**

## ORDER FORM

**PLEASE INDICATE** in which category of classified advertising you wish your ad to appear. For special headings, there is a surcharge of \$15.00.

☐ Plans/Kits    ☐ Business Opportunities    ☐ For Sale  
☐ Education/Instruction    ☐ Wanted    ☐ Satellite Television

**Special Category: \$15.00**

**PLEASE PRINT EACH WORD SEPARATELY, IN BLOCK LETTERS.**

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

**PLEASE INCLUDE FOR OUR FILES YOUR PERMANENT ADDRESS AND PHONE NUMBER.**

**CLASSIFIED COMMERCIAL RATE** for firms or individuals offering commercial products or services. \$1.90 per word prepaid (no charge for zip code)...**MINIMUM 15 WORDS.** 5% discount for 6 issues, 10% for 12 issues within one year, if prepaid.

**NON-COMMERCIAL RATE** (for individuals who want to buy or sell a personal item) \$1.25 per word prepaid...no minimum.

**ONLY FIRST WORD AND NAME** set in bold caps. Additional bold face (not available as all caps) at 15¢ per word. All copy subject to publisher's approval. **ADVERTISEMENTS USING P.O. BOX ADDRESS WILL NOT BE ACCEPTED UNTIL ADVERTISER SUPPLIES PUBLISHER WITH PERMANENT ADDRESS AND PHONE NUMBER.** Copy to be in our hands on the 20th of the third month preceding the date of the issue (i.e., August issue closes May 20th). When normal closing date falls on Saturday, Sunday, or a holiday, issue closes on preceding working day.

THE BEST PLACE to BUY, SELL or TRADE NEW and USED EQUIPMENT  
**NUTS & VOLTS MAGAZINE**  
 BOX 1111-E • PLACENTIA, CA 92670  
 (714) 632-7721  
 Join Thousands of Readers Nationwide Every Month  
**ONE YEAR U.S. SUBSCRIPTIONS**  
 \$7.00 - 3rd Class • \$12.50 - 1st Class  
 \$25.00 - Lifetime - 3rd Class

**NUTS & VOLTS**  
 HAM GEAR  
 COMPUTERS  
 SOFTWARE  
 SCANNERS • OPTICS  
 TEST EQUIPMENT  
 MICROWAVE  
 SATELLITE  
 AUDIO VISUAL  
 NEW PRODUCTS  
 COMPONENTS • KITS  
 ANTIQUE ELECT.  
 PUBLICATIONS  
 PLANS • SERVICES

**AMAZING Electronic Devices!** VOXs, miniature transmitters, telephone transmitters, wiretap defeats, and more! Send \$3.00 for catalog. **A.T.I.S.**, Dept. R, 61 Gatchell St., Buffalo, NY 14212.

**ALARM!** Vic 20/64 CoCo Sinclair become \$1000 burglar fire system. Cassette, documentation (specify microprocessor) \$29.00. Retailers inquire. Catalog. **SKIDMORE'S H.N'S**, 716 Walker, Greensboro, NC 27403. Sinclair piano, music program, cassette all hardware \$9.00.

**DESCRAMBLERS** for downconverters, high gain. Free information. **RB ELECTRONICS**, PO Box 643, Kalamazoo, MI 49005.

**PRINTED-circuit boards:** Your artwork, quick delivery, reasonable. Quantity discounts. **ATLAS CIRCUITS**, Dept. A, Box 892, Lincolnton, NC 28092 (704) 735-3943.

**UNUSUAL UHF** subscription TV kits and other units. Catalog 50 cents. **TROJAN**, 2920 Shelby, Indianapolis, IN 46203.

**CABLE TV converter/descrambler. Lowest price anywhere.** Oak N-12 or Jerrold SB-3 replacement \$79.00, combo with 35 channel converter \$139.00, Jerrold DRX-3DIC with remote \$179.00. Send \$2.00 with order or for catalog, refundable with your order to: **CK ELECTRONICS**, 397 Route 18 East, Suite 377, East Brunswick, NJ 08816, 201-739-2671.


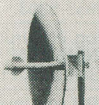


**PARABOLIC dishes** 20" \$6.95 ea. 28" \$15.00 ea. includes bracket. Lots of 100 pcs. **VIKING PRECISION, INC.**, 4631 South 35th Place, Phoenix, AZ 85040 (602) 276-6218.

**DELUXE** STV modules gated pulse sine wave SAAV1 no internal connection to TV micro wave cable much more brochure \$2.00 refundable. **LEETRONIX**, Box 253, Taylor, MI 48180.

**PICTURE flyer** lists quality electronics surplus at low prices. Since 1970. Send for the last 3 issues. **STAR-TRONICS**, Box 683, McMinnville, OR 97128.

**LATEST** bug-detection equipment for home or office. Literature, \$1.00. **CLIFTON**, Box 220-X, Miami, FL 33168.

**NEW! MULTI-CHANNEL MICROWAVE**  
 Complete Antenna Systems from \$69<sup>95</sup>  
 Full 800 Mhz Range  
 Tune 1.9-2.7 Ghz  
 Includes all ITFS Channels  
**DEALERS WANTED**  
 COD's and Credit Card Orders call TOLL FREE  
**1-800-247-1151**  
**GALAXY ELECTRONICS**  
 6009 N. 61 Avenue  
 Glendale, AZ 85301  
**1-602-247-1151**

 GOLD STAR  
 SILVER STAR  
 TELE STAR  
 STAR II



## FOR SALE

### P.C. BOARDS AND ART SERVICES

#### FACE PLATES ENCLOSURES

WRITE OR CALL  
For Literature or Quotes



Let us quote you  
on any stage of  
your product from  
proto types to  
production.

**FABTRON DIV.**  
P.O. Box 925  
Columbia, TN 38401  
(615) 381-1143

**THE Intelligence Library**—Restricted information & books on **electronic surveillance, surveillance-device schematics, lock-picking, investigation, weapons, identification documents, covert sciences**, etc. The best selection available. **Free brochures.** **MENTOR**, (Dept. Z), 135-53 No. Blvd., Flushing, NY 11354.

**MILITARY** communications receiver: R-174, tunes 1.5-18 MHz, AM-CW-SSB, amateur, shortwave frequencies: \$47.50 mint, \$27.50 good. Canadian backpack radio PRC-510, 38-54 MHz FM transceiver with headset, battery box, antenna: \$39.50 apiece, \$77.50/pair. ARC-27 guard receiver, single channel UHF aircraft receiver: \$12.50 mint. Add \$5/unit shipping. 45 day replacement guarantee. **BAYTRONICS**, Dept. RE, Box 591, Sandusky, OH 44870.

**TUBES**, new, unused. Send self-addressed, stamped envelope for list. **FALA ELECTRONICS**, Box 04134-2, Milwaukee, WI 53204.

**CABLE TV** equipment for "beeping" or "buzzing" channels. Information \$1.00. **GOLD COAST**, PO Box 63/6025F, Margate, FL 33063 (305) 752-9202.

**GEARMOTORS** \$35.00 12VDC 60rpm 3 amp. 1/2 in. shaft. Drives robots, antenna, boat steering, gates, etc. Also racks, pinions, chain, gears, etc. **SEPA CS**, 625 NW 41st, Seattle, WA 98107.

**UHF** high gain low noise preamp DX model TAX-35U 29 dB gain 300/75 ohm all ports reg \$114.50 now \$59.95 1 year warranty. **TELE VIDEO PRODUCTS**, 20224 North 17th Dr., Phoenix, AZ 85027 (602) 774-4735.

**FREE** pay TV reception. "How-To" book. HBO, Showtime, Cinemax. \$4.00. **DIPTRONICS**, Box 80AH, Lake Hiawatha, NJ 07034.

**FREE** sample issue! Buy/sell new and used computer hardware, software in electronics exchange. **BOX 486D**, Forest Lake, MN 55025.

**ELECTRONICS** parts, resistors, capacitors, LEDs, and more. Volume discounts and kits for builders. For free catalog write **SAMIK ELECTRONICS**, PO Box 222, Rochelle Park, NJ 07662.

**SOFTWARE** for Atari Apple's Commodore 64 VIC 20 TRS-80 TI's include self-addressed stamped envelope to **COMPUTER SOFTWARE CO.**, PO Box 3755, Bloomington, IL 61701.

**RESISTOR** assortment. 2200pcs. 1/4W5% C-Film. 110std. values, 20pcs. each, individually packed. \$29.95 postpaid check/M.O. accepted. COD \$2.00. **BENNETT CO.**, 1271 Merchandise Mart, Chicago, IL 60654 (312) 348-3341.

**FREE electronics parts catalog.** Product lines include solar, video, audio, phones, fans, batteries, capacitors, resistors, relays, transformers, and a variety of electronics parts. Write **HORIZON SALES, INC.**, PO Box 646, Framingham, MA 01701, or call (617) 875-4433.

**FREE speaker catalog!** Woofers, mids, tweeters, hardware, crossovers, grille cloth, kits, information, much more. **Discount prices.** **UNIVERSAL SOUND**, Dept. RE, PO Box 36052, Sarasota, FL 33583 (813) 953-5363.

**FREE catalog** of surplus electronics parts and hardware. **UNIVERSAL SOUND**, Dept. RES, PO Box 36052, Sarasota, FL 33583 (813) 953-5363.

**TUBES** \$2.49. Large inventory including rare types. **SASE** brings lists. **ADNF**, 6690 7 mile, S. Lyon, MI 48178.

**COLOR** computer owners—Free hardware and software catalog. **SPECTRUM PROJECTS**, 93-15 86 Drive, Woodhaven, NY 11421 (212) 441-2807.

## WANTED

**WANTED:** old Western Electric & RCA tubes, speakers, amplifiers. McIntosh, Marantz, tube amps. (713) 72884-343. **MAURY CORB**, 11122 Atwell, Houston, TX 77096.

## SATELLITE TELEVISION

**SATELLITE TV receiver breakthrough!** Build your own commercial quality receiver now! Complete instruction manual \$10.00! **XANDI**, Box 25647, Dept. 215, Tempe, AZ 85282.

**THE original Howard/Coleman TVRO receiver!** Instructions, schematics, layouts, printed-circuit boards: **ROBERT COLEMAN**, Rt., 3, Box 58-ARE, Travelers Rest, SC 29690.

**RECEIVE** 80 channels satellite system only \$1299.00. Complete information and order forms send \$3.00 to **REMINGTON'S SATELLITE SALES**, RR2, Box 124, Noblesville, IN 46060.

**SATELLITE** antennas: Build 8-10-12 foot wood or metal from \$43.00 send \$2.00 **PROTOTYPE ENGINEERS**, Box 1812, Deming, NM 88030.



## SATELLITE TV MAGAZINE

A monthly of 100-plus pages.

Product Information — Test Reports  
Antenna Installation — Legal Aspects

Satellite Television —  
the growth industry of the '80's.

Send \$1.00 for sample copy to  
**SATELLITE TV MAGAZINE**  
P.O. Box 2384 - Dept. R — Shelby, NC 28150

## BUSINESS OPPORTUNITIES

**WHOLESALE** MATV/CATV/VCR equipment, antennas, audio cables, adapters, original/replacement cartridges & styli, telephone accessories, radios, cassette recorders, speakers, etc., send letterhead for free catalog (212) 897-0509 **D&WR**, 66-19 Booth, Flushing, NY 11374.

**MECHANICALLY** inclined individuals desiring ownership of small electronics manufacturing business—without investment. Write: **BUSINESSES**, 92-R, Brighton 11th, Brooklyn, NY 11235.

**VIDEO** game repair business. Start your own. Information/parts list \$5.00. **BEST ELECTRONICS**, 4440 Sheena, Phoenix, AZ 85032.

**UP** to \$500.00 per month. Sell computer software in your home. Write to: **COMPUTER SERVICES**, PO Box 7748, Tucson, AZ 85725.

**SECURITY alarm industry** booming. Get in now. Tremendous demand employment-business terrific. Information package \$2.00 (redeemable) **SECURITY ELECTRONICS INTERNATIONAL**, PO Box 1456-N, Grand Rapids, MI 49501.

HIGHLY  
PROFITABLE

## ONE-MAN ELECTRONIC FACTORY

Investment unnecessary, knowledge not required, sales handled by professionals. Ideal home business. Write today for facts!

Postcard will do, **Barta-RE-X**, Box 248, Walnut Creek, CA 94597.

## REEL TO REEL TAPES

**AMPEX** professional series open reel tape, 1800- or 2400-feet on 7-inch reels, used once. Case of 40, \$45.00. 10 1/2" x 3600 feet and cassettes available. Master Card/Visa. **VALTECH ELECTRONICS**, Box 6-RE, Richboro, PA 18954 (215) 322-4866.

## CABLE TV

**DEALERS** wanted: Channel 3 notch filters, send \$15 for sample and quantity price list. **Money back guarantee.** **LEE KURTZ**, 235 SW 87th Ter., Plantation, FL 33324.

## CB EQUIPMENT

**CB** radio books, kits, modifications, catalog \$1.00 refundable. **APS**, PO 263RE, Newport, RI 02840.

## CABLE-TV EQUIPMENT

**DESCRAMBLERS** for cable TV model TX-200, amazing price, only \$79.95 compatible with Jerrold Starbase-3 or any gated pulse system. Automatic gain control. Highest quality components. One year guarantee. Other types available. Deluxe catalog \$3.00. **TELTECH**, 120 Wall Street, Suite 1044, Dept. RE 12, New York 1005.

## TI-99/4A SOFTWARE

**TI-99/4A** owners. Send for free list of new and exciting, low cost software. **DYNA**, Box 124, Hicksville, NY 11801.

## EPROM PROGRAMMING SERVICE

**EPROM** programming service for hobbyists and commercial users. All common EPROM types. Write for complete listing and price information. **ELECTRONIC COMMUNICATIONS SERVICES**, PO Box 441, Franklin Park, IL 60131.

## FREE LCD WATCH WITH KIT

**LSR** UHF converters with AGC: gated pulse wave BT-1 (speaker box), \$115.00. Sound out from the TV type: deluxe IIB sine wave, parts \$100.00; new! I. F. sine wave, \$55.00; Digital Z/FV-5, \$175.00. Quantity discounts. Plans: large SASE (54 cents postage). Free shipping/handling. (1-312) 267-3455. **LSR ENGINEERING**, Dept. RE, Box 6075, Chicago, IL 60680-6075.

## REVERBERATION FOR ORGANS

Solid state with controls for reverb-  
eration and room size.

**EVERY ORGAN SHOULD  
OWN ONE.**

Send for free flyer—

**DEVTRONIX ORGANS, INC.**  
6101 WAREHOUSE WAY  
SACRAMENTO, CALIFORNIA 95826 Dept. B

## SINCLAIR/TIMEX

**ARTIFICIAL** intelligence program. Converse with your TS1000/ZX81 16K. Cassette \$11.95. **DYNA-BYTE**, Box 2021, Michigan City, IN 46360.

## DON'T BUY ANYTHING

**UNTIL** you check our low prices! UHF converters, microwave antennas, Jerrold equipment, mini-TV's, personal computers, car stereos, video games, answering machines, audio, video and much more! Send \$2.00 for latest catalog today! **THREE CROWNS ELECTRONICS**, Dept. R-12, PO Box 343, Brooklyn, NY 11230.

## USA PAY-TV STATIONS

**COMPLETE** and latest data you always wanted to know. Locations, programming, equipment and more. Just \$9.95. **THREE CROWNS ELECTRONICS**, PO Box 343, Dept. R-12, Brooklyn, NY 11230.

## SATELLITE TV VIEWERS

Get the most complete weekly listings.  
Send \$1 for sample copy.

**Satellite TV Week**

P.O. Box 308, Fortuna, California 95540  
800-338-9997 (U.S.) • 800-556-8787 (Calif.)  
707-725-2476 (all others)

## COMPUTERS

**TOP** name brand programs and games—try before you buy! Don't get burned, info: **SEMI-Z**, RD4, Box 69, Danville, PA 17821.

## VIC-20

**SIX** games on cassette. Great graphics. Send \$15.00 to **GAMES**, 604 Blake Circle, Stedman, NC 28391.







# ETCO

## AMERICA'S ELECTRONIC SUPER STORE

**SPECIAL OFFER ON A 40 CHANNEL  
CABLE TV BLOCK CONVERTER**

PERFORMS LIKE A \$50. UNIT!



698AE380, Matching Trans-  
former (1 required)...99<sup>99</sup> ea.  
698VA754...3' Jumper Cable  
(1 required).....2.49 ea.

Incredible value on one of the  
most popular converters in  
America. (Not a Descrambler).  
Call our Hi-Tech Dept. (518-  
561-8700) for expert  
assistance in selecting the  
proper converter for your area  
(These are repaks with a 90  
day warranty). 698MG004

**LONG RANGE  
WIRELESS  
MICROPHONE  
SALE!**

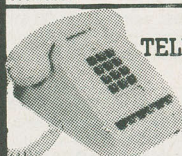
Long range wireless  
Microphone. Crystal controlled  
battery operated. Complete  
with receiver. F.C.C. ap-  
proved. ETCO has Wireless  
Microphones in stock for up  
to \$1000. Call us today for  
help in choosing the right  
model for your application.  
698MG005.

SAVE \$30.01

**39<sup>99</sup>**

AT ETCO

A \$70.00 VALUE!



**3 LINE PUSHBUTTON  
TELEPHONES FOR YOUR  
HOME OR OFFICE**

**99<sup>95</sup>**

Etco's Hi-Tech Information Center is "Telephone Smart"

These units require no central key equipment. Provides hold  
facilities on all lines. Cable terminated in Amphenol type  
plug. 7 colors available. Call us today for more information.

SAVE \$30. ON THIS MONTH'S SPECIAL!

**OUR VERY POPULAR VIDEO STABILIZER/  
ENHANCER/ FADER/RF MODULATOR  
AND DISTRIBUTION AMPLIFIER**

**89<sup>95</sup>** \$119.95 IN  
OUR  
CATALOG



The ultimate video accessory combines a stabilizer to end  
vertical roll and jitter, an enhancer to produce sharp and fully  
saturated copies, a video fader for professional fade-to-black  
effects, an RF converter for direct hookup to any TV set, and a  
distribution amplifier to allow multiple copies to be made  
without any appreciable signal loss. And ETCO brings it to  
you at a very affordable price. Order yours today. 698MG003.

**RUSH YOUR ORDER TO**

**ETCO** ELECTRONICS  
NORTH COUNTRY SHOPPING CENTER  
PLATTSBURGH, N.Y. 12901

Check with order, please. Visa & Mastercard O.K. (Sorry, no  
C.O.D.'s. Add 15% for UPS & Handling (Excess refunded). N.Y.  
State residents add sales tax. Dealer & Export Inquiries In-  
vited. Our telephone order desk never closes.

Call 1-518-581-8700

## CATALOGS & BOOKS

- ☐ Yes, I would like a 1 year subscription to the  
fascinating ETCO catalog. I enclose \$1 to  
cover postage.
- ☐ Rush me a free sample copy of the latest 112  
page ETCO catalog. (USA only)
- ☐ Foreign & Canadian 1 year catalog subscrip-  
tion. I enclose \$3.
- ☐ I enclose \$13. Please rush me the 500  
page Giant Book of Electronic Projects.  
TA262
- ☐ I enclose \$12. Please rush me the 360 page  
MASTER HANDBOOK OF TELEPHONES.  
TA001
- ☐ I enclose \$10. Please rush 304 page "BUILD  
YOUR OWN EARTH STATION". TA025

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_ ZIP \_\_\_\_\_

**MAIL COUPON TO:**

ETCO ELECTRONICS  
Dept. 699  
BOX 640  
Champlain, N.Y. 12919



**NOW  
112  
PAGES**

CIRCLE 50 ON FREE INFORMATION CARD

## NEW! PACCOM LED LAMP CATALOG.



This new Paccom 6-page catalog  
contains complete electronic and  
mechanical specifications for a broad  
range of standard lamps, rectangular,  
triangular, cylindrical, square, and  
Tri-Color LEDs, and LED arrays.

Paccomm Light Emitting Diodes...  
performance and price you can  
count on.

For immediate action call toll-  
free 1-800-426-6254 or check Reader  
Service Card.



Dept. RE113, 3928 148th N.E.,  
Redmond, WA 98052 (206) 883-9200

CIRCLE 81 ON FREE INFORMATION CARD

# SKYFOX

State-of-the-Art Excellence

SKYFOX DESIGN PERFORMANCE FEATURES:

- Gain 55 db • Frequency 1.9-2.5 GHz
- Range 55 miles maximum • Tuning channels 2-6
- 20 inch Parabolic dish antenna • 60 ft. cable
- Cable adapters, mounting brackets and hardware included
- Illustrated instructions



Receive movies, special presentations and educa-  
tional broadcasts—ALL FREE—with the SKYFOX  
deep fringe microwave receiver for homeowners  
outside the service area of microwave TV stations.  
SKYFOX receives up to a distance of 55 miles.  
From microwave transmitters located on buildings  
or towers in almost all medium and large size  
cities. SKYFOX does not receive Cable TV or  
satellite transmissions.

SKYFOX I \$ 79.95 (not pictured, 25 mile line of site)

SKYFOX II \$109.95 (as shown, 55 mile line of site)

ORDERS ONLY: Toll Free 1-800-323/1327

For Information Call: 1-312/564-0104

Visa, Mastercharge accepted, COD, cash or Money Order  
only. When ordering by mail, Money Orders or Cashiers  
Checks only. Personal checks, wait 4 weeks for check  
clearance.

90 day warranty • Conditional money back guarantee

**S.E.I. Inc.**

657 Academy Drive  
Northbrook, Illinois 60062

Available by  
Mail Order Only

CIRCLE 64 ON FREE INFORMATION CARD

## Radio-Electronics REPRINT BOOKSTORE

- ☐ Build Your Own Satellite TV Receiver ..... \$7.00
- ☐ 8-Ball Satellite TV Antenna ..... \$5.00
- ☐ Build Your Own Robot ..... \$12.00
- ☐ TV Descrambler (January, February 1981) ..... \$3.00
- ☐ Radio-Electronics back issues (1983) ..... \$3.00  
(January, February 1983 not available)  
Write in issues desired
- ☐ Radio-Electronics back issues (1982) ..... \$3.50  
(January 1982 not available)  
Write in issues desired
- ☐ Radio-Electronics back issues (1981) ..... \$4.00  
(March, December 1981 not available)  
Write in issues desired
- ☐ Etch your own PC Boards ..... \$3.00

- ☐ Special Projects (Spring 1981) ..... \$4.50
- ☐ Special Projects #4 (Summer 1982) ..... \$4.50
- ☐ Special Projects #5 (Winter 1983) ..... \$4.00
- ☐ Special Projects #6 (Spring 1983) ..... \$3.50
- ☐ Special Projects #8 (Winter 83) ..... \$3.00
- ☐ Radio-Electronics Annual 1983 ..... \$3.50
- ☐ Radio-Electronics Annual 1984 ..... \$2.50
- ☐ Radio-Electronics Annual ..... \$2.50
- ☐ How to Make PC Boards ..... \$2.00
- ☐ All About Kits ..... \$2.00
- ☐ Modern Electrics (Vol. 1, #1, ..... \$2.25  
April 1908)
- ☐ Electro Importing Co. Catalog ..... \$4.95  
(1918) (176 pp)

To order any of the items indicated above, check off the ones  
you want. Complete the order form below, include your pay-  
ment, check or money order (DO NOT SEND CASH), and mail  
to Radio-Electronics, Reprint Department, 200 Park Ave.  
South, New York, NY 10003. Please allow 4-6 weeks for  
delivery.

If you need a copy of an article that is in an issue we indicate is  
unavailable you can order it directly from us. We charge 50¢  
per page. Indicate the issue (month & year), pages and article  
desired. Include payment in full, plus shipping and handling  
charge.

ARTICLE \_\_\_\_\_

MONTH \_\_\_\_\_

YEAR \_\_\_\_\_

PAGES \_\_\_\_\_

\_\_\_\_\_ @ 50¢ each

TOTAL PAGES \_\_\_\_\_

TOTAL PRICE \_\_\_\_\_

MAIL TO: **Radio-Electronics**

Reprint Department, 200 Park Ave. South, New York, NY 10003

12-83

All payments must be in U.S. funds

Total price of order ..... \$ \_\_\_\_\_  
Sales Tax (New York State Residents only) ..... \$ \_\_\_\_\_  
Shipping & Handling (U.S. & Canada only) (Includes FIRST CLASS POSTAGE) \$1.00 per item ..... \$ \_\_\_\_\_  
All other (\$2.00 per item, sea mail) ..... \$ \_\_\_\_\_  
(\$4.00 per item, air mail) ..... \$ \_\_\_\_\_

Total Enclosed ..... \$ \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_



# WHY DO SMART BUILDERS SHOP THE SHACK®?

High Quality!

No Minimum Order!

No Mail-Order Delays!

## Replacement Transistors

Type	Cat. No.	Each
2N1305	PNP 276-2007	1.19
MPS222A	NPN 276-2009	.79
PN2484	PNP 276-2010	.89
MPS3904	NPN 276-2016	.69
TIP31	NPN 276-2017	.99
TIP3055	NPN 276-2020	1.59
MPS2907	PNP 276-2023	.79
MJE34	PNP 276-2027	1.49
2N3053	NPN 276-2030	.89
MPS3638	PNP 276-2032	.79
TIP120	NPN 276-2068	1.29
2N3055	NPN 276-2041	1.99
MJ2955	PNP 276-2043	2.19
2N4124	NPN 276-2057	.59
2N4401	NPN 276-2058	.59
MPSA06	NPN 276-2059	.59
MPSA13	NPN 276-2060	.59
MPSA42	NPN 276-2061	.69
MU4891	UJT 276-2029	.99
2SD313	NPN 276-2048	1.79
2SC945	NPN 276-2051	.79
2SC1308	NPN 276-2055	7.95
2N3819	N-FET 276-2035	.99
MPF102	N-FET 276-2062	.99

## 4000-Series CMOS ICs

With Pin-Out and Specs

Type	Cat. No.	Each
4001	276-2401	.79
4011	276-2411	.79
4013	276-2413	.99
4017	276-2417	1.49
4023	276-2423	.99
4049	276-2449	.99
4066	276-2466	.99

## TTL Digital ICs

With Pin-Out and Specs

Type	Cat. No.	Each
7400	276-1801	.59
7404	276-1802	.79
7408	276-1822	.79
7447	276-1805	1.19
7490	276-1808	.89

## Operational Amplifiers

Type	Cat. No.	Each
741	(Single) 276-007	.79
MC1458	(Dual) 276-038	.99
LM324	(Quad) 276-1711	1.29
TL082	(Dual) 276-1715	1.89
TL084	(Quad) 276-1714	2.99
LM3900	(Quad) 276-1713	1.39
LM339	(Quad) 276-1712	1.49

## Audio Power Amplifiers

Type	Cat. No.	Each
LM383/TDA2002	276-703	3.19
LM386	276-1731	1.09
TA7205AP	276-705	2.99
LM380	276-706	1.59

## Voltage Regulator ICs

Type	Adjustable	Cat. No.	Each
LM723	0 to 40 VDC	276-1740	.89
LM317T	1.2 to 37 VDC	276-1778	2.79
Type	Fixed Output	Cat. No.	Each
7805	+5 VDC	276-1770	1.59
7812	+12 VDC	276-1771	1.59
7815	+15 VDC	276-1772	1.59
7905	-5 VDC	276-1773	1.59
7912	-12 VDC	276-1774	1.59

## Computer Connectors

Type	Positions	Cat. No.	Each
ID Card Edge	34	276-1564	4.95
ID Card Edge	50	276-1566	4.95
Card-Edge Socket	44	276-1551	2.99
ID D-Sub Male	25	276-1559	4.99
ID D-Sub Female	25	276-1565	4.99
Solder D-Sub Male	25	276-1547	2.99
Solder D-Sub Female Hood	25	276-1548	3.99
		276-1549	1.99

## Power Transformers

120VAC Primaries

Type	Volts	Current	Cat. No.	Each
Mini	6.3	300 mA	273-1384	2.59
Mini	12.0	300 mA	273-1385	2.79
Mini	24.0	300 mA	273-1386	2.99
Mini	12.0	CT 450 mA	273-1365	3.59
Mini	24.0	CT 450 mA	273-1366	3.99
Std.	6.3	1.2A	273-050	3.79
Std.	12.6 CT	1.2A	273-1505	3.99
Std.	25.2	1.2A	273-1480	4.39
H-D	12.6 CT	3.0A	273-1511	5.99
H-D	25.2 CT	2.0A	273-1512	6.29
H-D	18.0 CT	2.0A	273-1515	6.99

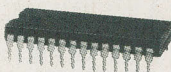
## Tantalum Capacitors

- 20% Tolerance
- Standard IC Pin Spacing

μF	WVDC	Cat. No.	Each
0.1	35	272-1432	.49
0.47	35	272-1433	.49
1.0	35	272-1434	.49
2.2	35	272-1435	.59
10	16	272-1436	.69
22	16	272-1437	.79

## Special-Purpose ICs

Voice Synthesizer Set



SP0256,  
28-Pin



SPR16,  
14-Pin

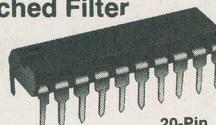
**1295**

Set of 2 ICs

**SP0256 Speech Processor.** The easy, low-cost way to get into "solid-state" talk! NMOS LSI device uses a stored program to synthesize speech or complex sounds. It operates with a few simple support parts, or use the SPR16 Serial Speech ROM, included, for microcomputer interfacing. SPR16 contains 32 "talking clock" statements, three melodies. With data, circuit examples. Requires 3.12 MHz clock crystal—order through your local Shack. **276-1783** ..... **Set 12.95**

## Dual Switched Filter

**NEW!**  
**799**



20-Pin

Capacitors Not Required

**MF10.** Versatile CMOS building block for active filters—eliminates the need for expensive, close-tolerance parts. High performance, yet very easy to use. Requires only six resistors and 150 kHz clock for a 4th order, 1 kHz Butterworth low-pass. A complete filter for a full-duplex 300-baud modem needs only two MF10s, 15 resistors, clock and  $\pm 5$ VDC! Center frequencies up to 20 kHz. Clock to center frequency ratio accuracy: 6%. Single or split supply. With data. For more information, see article by Forrest Mims III, page 86, July "Computers & Electronics" **276-2329** ..... **7.99**

## 1/4-Watt, 5% Resistors

**39¢**

Pkg. of 5

Ohms	Cat. No.	Ohms	Cat. No.
10	271-1301	10k	271-1335
100	271-1311	15k	271-1337
150	271-1312	22k	271-1339
220	271-1313	27k	271-1340
270	271-1314	33k	271-1341
330	271-1315	47k	271-1342
470	271-1317	68k	271-1345
1k	271-1321	100k	271-1347
1.8k	271-1324	220k	271-1350
2.2k	271-1325	470k	271-1354
3.3k	271-1328	1 meg	271-1356
4.7k	271-1330	10 meg	271-1365
6.8k	271-1333	—	—

## Miniature PC-Mount Pots

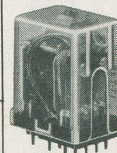
1/8-Watt, Horizontal-Mount

Ohms	Cat. No.	Each
1k	271-333	.49
10k	271-335	.49
25k	271-336	.49
100k	271-338	.49
500k	271-339	.49

1/4-Watt, Vertical-Mount

Ohms	Cat. No.	Each
500	271-226	.59
1k	271-227	.59
5k	271-217	.59
10k	271-218	.59
50k	271-219	.59
100k	271-220	.59
500k	271-221	.59
1 meg	271-229	.59

## Miniature 4PDT Relay



**469**

Switches up to four circuits! For PC or socket mounting. 120 VAC coil.  $1\frac{3}{8} \times 1\frac{1}{8} \times 1\frac{3}{16}$ "  
**275-214** ..... **4.69**

## Illuminated Switch

**SPDT Push-On/Push-Off.** 3 amps at 120VAC. Built-in 12-volt, AC/DC lamp. Mounts in  $\frac{1}{2}$ "-dia. hole. **275-676** ... **4.95**

**495**



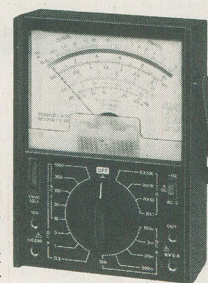
## Learn Robotics

Fully illustrated and written in everyday language, this 256-page book covers everything from single-loop systems to complex robots used in industry. Learn how electronics can help increase productivity. **62-1387** ..... **2.95**

## Sale! 27-Range Multitester

**Save** Reg. 34.95  
**\$5 29.95**

Reduced 14% Measures 0 to 1000 volts, AC and DC. 0 to 10 amps DC current in five ranges. Resistance to 10 megohms. Decibels: -10 to +62. 30,000 ohms per volt sensitivity.  $6\frac{1}{4} \times 4\frac{1}{2} \times 2\frac{3}{4}$ ". With test leads and manual. Batteries extra. **22-203** ... **Sale 29.95**



Big 4" Meter

OVER 8800 LOCATIONS WORLDWIDE

**Radio Shack®**

Prices apply at participating Radio Shack stores and dealers

CIRCLE 61 ON FREE INFORMATION CARD

A DIVISION OF TANDY CORPORATION

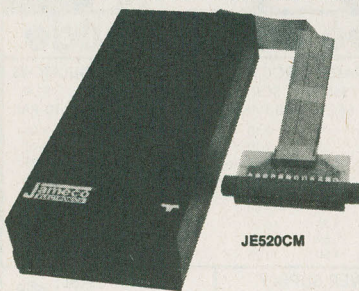
DECEMBER 1983







## VOICE SYNTHESIZER FOR APPLE AND COMMODORE



JE520CM

• Over 250 word vocabulary - affixes allow the formation of more than 500 words • Built-in amplifier, speaker, volume control, and audio jack • Recreates a clear, natural male voice • Plug-in user ready with documentation and sample software • Case size: 7 1/4" L x 3 1/4" W x 1-3/8" H

### APPLICATIONS:

- Security Warning
- Teaching
- Instrumentation
- Telecommunication
- Handicap Aid
- Games

The JE520 VOICE SYNTHESIZER will plug right into your computer and allow you to enhance almost any application. Utilizing National Semiconductor's DIGITALALKER™ Speech Processor IC (with four custom memory chips), the JE520 compresses natural speech into digital memory, including the original inflections and emphasis. The result is an extremely clear, natural vocalization.

Part No.	Description	Price
JE520CM	For Commodore 64 & VIC-20	\$114.95
JE520AP	For Apple II, II+, and IIe	\$149.95

## Micro-Logic Corp. MICRO-CHARTS

• Fully decoded data • Instant access • 2-sided, totally comprehensive • Compact 8 1/2 x 11 in. durable card • Perfect for programmers & engineers • Clear & concise tables for: full instruction set, disassembly, ASCII, base conversion, effect of flags, compare vs. jump, interrupt structure, pinout, cycle times, diagrams, bug notes, & much more...

PART NO.	REFERENCE	PRICE
ML-Z80	Z80 CPU	\$5.95
ML-8080A	8080A/8085A	\$5.95
ML-6502	6502 (65XX)	\$5.95
ML-8048	8048, Relatives	\$5.95
ML-7400	5400/7400 TTL Pin-Outs	\$5.95

## BOOKS

30001	National CMOS Data Book (1981)	\$6.95
	(640 pages) 74C, CD4000, and A/D Converters	
30003	National Linear Data Book (1982)	\$11.95
	(1376 pages) LM, LF, ADC, DAC, LH Series	
30008	National Memory Data Book (1980)	\$6.95
	(464 pages) RAMs, ROMs, PROMs, EPROMs Series	
30009	Intel Data Book (1983)	\$9.95
	(1356 pages) Complete line	
30010	National Audio/Radio Handbook (1980)	\$5.95
	(240 pages) Pre-Amps, AM, FM & FM Stereo, Power Amps	
30012	National PAL Data Book (1982)	\$5.95
	(176 pages) Application Notes, Linear Briefs, etc.	
30013	Zilog Data Book (1983)	\$7.95
	(641 pages) Microprocessors and Support Chips	
210830	Intel Memory Components Handbook (1983)	\$14.95
	(798 pages) Contains all Application Notes, Article Reprints, Data Sheets, and other design information on Intel's RAMs, EPROMs, EPRoMs & Bubble Memories.	
210844	Intel Microprocessor & Peripheral Handbook (1983)	\$14.95
	(1027 pages) Contains Data Sheets on all of Intel's Microprocessors and Peripherals.	

## 4-Digit Fluorescent Alarm Clock Kit



• Bright 4-digit 0.5" high display • 10 minute snooze alarm • AM/PM indicator

The JE750 Clock Kit is a versatile 12-hour digital clock with 24-hour alarm. The clock has a bright 0.5" high blue-green fluorescent display. The 24-hour alarm allows the user to disable the alarm and immediately re-enable the alarm to activate 24 hours later. The kit includes all documentation, components, case and wall transformer. Size: 6-5/8" L x 3 1/4" W x 1 1/4" D.

JE750 Alarm Clock Kit ..... \$29.95

## Jameco Digital Thermometer Kit



JE300 ..... \$39.95

## Universal Computer Keyboard Enclosures

DTE-8	Panel Width 7.5"	\$24.95
DTE-11	Panel Width 10.13"	\$27.95
DTE-14	Panel Width 13.5"	\$29.95
DTE-20	Panel Width 19.25"	\$34.95
DTE-22	Panel Width 21.375"	\$39.95

CARD-EDGE CONNECTORS			
Part No.	No. of Contacts/Conductors	1-9	10-99 100+
C20	20	2.30	2.99 1.00
C26	26	2.60	2.99 1.00
C34	34	3.20	2.99 1.00
C40	40	3.60	2.99 1.00
C50	50	4.30	3.95 1.30

## SOLDER TRANSITION CONNECTORS FOR PERMANENT TERMINATION TO PRINTED CIRCUIT BOARDS

Part No.	No. of Contacts/Conductors	1-9	10-99 100+
ST20	20	1.15	.90 .85
ST26	26	1.25	1.15 .90
ST34	34	1.40	1.35 1.15
ST40	40	1.60	1.55 1.35
ST50	50	1.80	1.65 1.40



## 36-Pin CENTRONICS RIBBON CONNECTORS

Part No.	No. of Contacts/Conductors	1-9	10-99 100+
CEN14M	14 Male	6.30	5.49 .40
CEN14F	14 Female	6.10	5.29 .40
CEN24M	24 Male	7.95	6.95 .50
CEN24F	24 Female	7.60	6.79 .50
CEN36M	36 Male	8.60	7.59 .60
CEN36F	36 Female	8.75	8.95 .75

## 28AWG FLAT GREY CABLE

Part No.	No. of Contacts/Conductors	Connector & Wire Type	Price Per Foot
171-9	9	28AWG Flat Stranded	.19
171-14	14	28AWG Flat Stranded	.23
171-15	15	28AWG Flat Stranded	.27
171-16	16	28AWG Flat Stranded	.29
171-17	17	28AWG Flat Stranded	.30
171-20	20	28AWG Flat Stranded	.36
171-24	24	28AWG Flat Stranded	.45
171-25	25	28AWG Flat Stranded	.47
171-26	26	28AWG Flat Stranded	.49
171-34	34	28AWG Flat Stranded	.65
171-36	36	28AWG Flat Stranded	.65
171-37	37	28AWG Flat Stranded	.69
171-40	40	28AWG Flat Stranded	.75
171-50	50	28AWG Flat Stranded	.89

## ACCESSORIES FOR APPLE\* COMPUTERS

### Numeric/Auxiliary Keypad for APPLE II\*



The JE14 is a newly introduced numeric/auxiliary keypad for the APPLE II\*. It offers the flexibility of a 10-key pad and the convenience of 23 directly accessible functions. Screen manipulating functions make word processing a snap and cursor controls make the keypad ideal for VisiCalc™ users. The JE14 keypad is housed in a durable metal enclosure and is color-coordinated with your APPLE II computer. Operation of the keypad can begin within minutes from unpacking. Special functions include: Home, Clear, Clear to End of Screen, Scroll-Up, Scroll-Down, Tab, Delete, Left, Right, Up and Down. Each key has auto-repeat.

JE14 Assembled and Tested ..... \$89.95

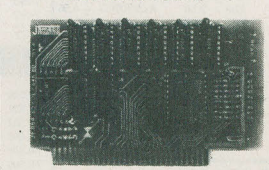
### Switching Power Supply for APPLE II, II+ and II\*



Part No. KHP4007 ..... \$79.95

\*APPLE and APPLE II are registered trademarks of APPLE Computers. \*VisiCalc is a registered trademark of Visi Corp. Inc.

### Extended 80 Column/64K RAM Card for APPLE II\*



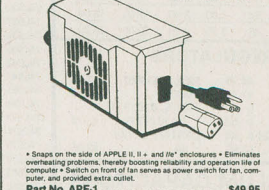
Now you can double the memory capacity and get an 80 column display format for your APPLE II computer at an affordable price. Just plug the JE84 card into your APPLE II and expand your display to 80 characters per line. Perfect for word processing. The JE84 also features 64K bytes of additional memory to allow programming not possible with standard APPLE II computers.

Board: High density board design squeezes 64K bytes of RAM onto a 2 1/2" x 4 1/2" board • Fully tested to assure proper operation

Uses: Word processing — displays 1000 more characters per screen • Extra memory allows running of extremely large programs • Ultra High Resolution Graphics (when software available)

JE84 Assembled and Tested ..... \$149.95

### Cooling Fan for APPLE II, II+ and II\*



Part No. APF-1 ..... \$49.95

\*APPLE and APPLE II are registered trademarks of APPLE Computers. \*VisiCalc is a registered trademark of Visi Corp. Inc.

### POWER SUPPLY +5VDC @ 7.5 AMP, 12VDC @ 1.5 AMP SWITCHING

Input: 115VAC, 50-60Hz @ 3 amp/230VAC, 50Hz @ 1.5 amp. Fan vent./power supply select switches 115/230VAC. Output: 5VDC @ 7.5 amp, 12VDC @ 1.5 amp. 8 pin. pow. cord. 11 1/2" W x 13 1/4" D x 3 1/4" H. Wt. 6 lbs.

Part No. PS94V05 ..... \$39.95 each

### POWER SUPPLY 4-Channel Switching - Apple Compatible

Microprocessor, mini-computer, terminal, medical equipment and process control applications. Input: 90-130VAC, 47-440Hz. Output: +5VDC @ 5A, -5VDC @ 1A, +12VDC @ 1A, -12VDC @ 1A. Line reg.: ±0.2%, Ripple: 30mV p-p. Load reg.: ±1%. Overcurrent protection. Adj: 5V main output ±10%, 6-3/8" L x 1-7/8" W x 4-15/16" H. Wt. 1 1/2 lbs.

Part No. FCS-604A ..... \$69.95 each

### 10.00 Minimum Order — U.S. Funds Only California Residents Add 6 1/2% Sales Tax Shipping — Add 5% plus \$1.50 Insurance Send S.A.S.E. for Monthly Sales Flyer!

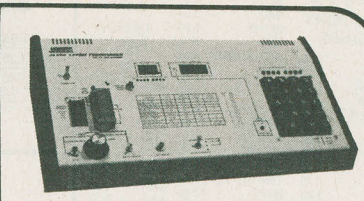
Mail Order Electronics • Worldwide

Spec Sheets — 30¢ each Send \$1.00 Postage for your FREE 1984 JAMECO CATALOG Prices Subject to Change

MasterCard JAMECO ELECTRONICS VISA

1355 SHOREWAY ROAD, BELMONT, CA 94002 12/83 PHONE ORDERS WELCOME — (415) 592-8097 Telex: 176043

CIRCLE 41 ON FREE INFORMATION CARD



## JE664 EPROM PROGRAMMER 8K TO 64K EPROMS — 24 AND 28 PIN PACKAGES

• Programs, validates, and checks for properly erased EPROMs • Emulates PROMs or EPROMs • RS232C Computer Interface for editing/program loading • Loads data into RAM by keyboard • Changes data in RAM by keyboard • Loads RAM from an EPROM • Compares EPROMs for content differences • Copies EPROMs • Power Input: 115VAC, 60Hz, ±10% power consumption • Enclosure: Color-coordinated, light tan panels w/molded mocha brown end pieces • Size: 15-5/8" L x 8 1/4" D x 3 1/4" H • Wt.: 5 1/4 lbs.

JE664-A EPROM Programmer ..... \$995.00

Assembled & Tested (includes JM16A Module)

JE665 — RS232C INTERFACE OPTION — The JE665 RS232C interface option implements computer access to the JE664's RAM. Sample software written in BASIC provided for TRS-80\* Model I, Level II Computer. Baud rate: 9600. Word length: 8 bits — odd parity. Stop bits: 2. Option may be adapted to other computers. The JE665 can be interfaced to any computer with an RS232C port. Information is also provided for interfacing to any CP/M system with an RS232C port.

JE664-ARS EPROM Programmer w/JE665 Option ..... \$1195.00

Assembled & Tested (includes JM16A Module)

EPROM JUMPER MODULES — The JE664's JUMPER MODULE (Personality Module) is a plug-in Module that pre-sets JE664 for proper programming purposes to the EPROM & configures EPROM socket connections for that particular EPROM.

PIN	EPROM	EPROM MANUFACTURER	PRICE
JM08A	2708	AMD, Motorola, National, Intel, TI (25V)	\$14.95
JM16A	2716, TMS2716	Intel, Motorola, National, NEC, TI (25V)	\$14.95
JM16B	TMS2716	Motorola, TI (+5, -5, +12)	\$14.95
JM32A	TMS2532	Motorola, TI (25V)	\$14.95
JM32B	2732	AMD, Fujitsu, NEC, Hitachi, Intel (25V)	\$14.95
JM32C	2732A (21V)	Fujitsu, Intel (21V)	\$14.95
JM4A	MC68074, MC68074A	Motorola (21V)	\$14.95
JM68B	2764	Intel (21V)	\$14.95
JM64C	TMS2564	TI (25V)	\$14.95
JM64D	HN482764G-4	Hitachi (21V)	\$14.95

## UV-EPROM Eraser



8 Chips — 51 Minutes

1 Chip — 37 Minutes

Erases 2708, 2716, 2732, 2764, 2516, 2532, 2564. Erases up to 8 chips within 51 minutes (1 chip in 37 minutes). Maintains constant exposure distance of one inch. Special conductive foam liner eliminates static build-up. Built-in safety lock to prevent UV exposure. Compact — only 9.00" x 3.70" x 2.60". Complete with holding tray for 8 chips.

## DE-4 UV-EPROM Eraser ..... \$79.95

UVS-11EL Replacement Bulb ..... \$16.95



5 1/4" APPLE™ COMPATIBLE DISK DRIVE

• Uses Shugart S4390 mechanics • 143K formatted storage • 35 tracks — compatible with Apple controller • Complete with connector and cable — just plug into your disk controller card • Size: 6 1/2" L x 3 1/4" W x 8-9/16" D • Weight: 4 1/2 lbs

Part No. ADD-514 ..... \$195.95

## 8" FLOPPY DISK DRIVE



• Shugart 801R compatible

• Single-Sided

• 77 Tracks

• 400/800K Bytes Capacity

• Industry Standard

The FDD100-8 8" Floppy Disk Drive (Industry Standard) features single or double density. Recording mode: single, MFM double density. Transfer rate: 250K bits/sec. single density; 500K bits/sec. double density. The FDD100-8 is designed to work with the single-sided, sectorized IBM Diskette I, or 800 disk cartridge. Power: 115VAC @ 50-60Hz, +24VDC @ 1.7 amp max., +5VDC @ 1.2 amp max. Unit as pictured above (does not include case, power supply, or cables). Size: 8.55" W x 14 1/4" L x 4 1/2" H. Weights 12 lbs. Incl. 96pg. manual.

Part No. FDD100-8 ..... \$169.95 ea.

## IBM MEMORY EXPANSION KIT

### SAVE HUNDREDS OF \$\$\$ BY UPGRADING MEMORY BOARDS YOURSELF!

Most of the popular memory boards allow you to add an additional 64K, 128K, 192K, or 256K. The IBM64K Kit will populate these boards in 64K byte increments. The kit is simple to install — just insert nine 64K RAM chips in the provided sockets and set the two groups of switches. Directions are included.

IBM64K (Nine 200ns 64K RAMs) ..... \$49.95

## EXPAND YOUR MEMORY

TRS-80 to 16K, 32K, or 48K

\*\*Model 1 — From 4K to 16K Requires (1) One Kit

Model 3 — From 4K to 48K Requires (3) Three Kits

Color — From 4K to 16K Requires (1) One Kit

\*\*Model 1 equipped with Expansion Board up to 48K Two Kits Required — One Kit Required for each 16K of Expansion —

TRS-16K3 \*200ns for Color & Model III ..... \$12.95

TRS-16K4 \*250ns for Model I ..... \$10.95

TRS-80 Color 32K or 64K Conversion Kit

Easy to install kit comes complete with 8 ea. 4164-2 (200ns) 64K dynamic RAMs & conversion documentation. Converts TRS-80 color computers with E-circuit boards, & all new color computers to 32K. Minor modifications of 32K memory will allow the use of all the 64K of the dynamic RAM providing you have a FLEX DOS operating system.

TRS-64K2 ..... \$44.95



CPU's & SUPPORT CHIPS		INTER FACE & DRIVERS	
8035	4.95	8257 (AM9517)	7.95
8038	6.95	8258	5.95
8080A	2.75	8385	12.95
8085A	7.50	8502	5.95
AMD 2901	8.95	280A CPU	4.75
8202	19.95	280B CPU	12.95
8212	1.80	280A S10	10.95
8214	3.80	280A P10	4.95
8216	1.75	280A CTC	6.75
8224	2.25	TMS 8927 NL	9.95
8226	1.80	8803L	12.95
8228	3.50	8845	13.95
8155	6.00	8809	6.95
8156	8.95	8810	2.50
8237	14.00	8821	2.95
8238	3.95	8850	2.95
8755	19.95	8875	4.50
8250	10.95	8800L8	39.50
DISC CONTROLLERS		SHIFT REGISTERS	
AT17472	9.95	MM1402	1.75
AY5-10150/575		MM1403	1.75
AY5-1013A/375		MM1404	1.75
AY5-3600	9.95	MM5013	2.50
RAM's		ROM's	
2101A-4	1.50	2708	3.50
2102-3	.70	2716 + 5V	4.95
2111A	1.95	2732	7.95
2114-2	1.40	2732A-2	9.90
2147-3	2.50	2752	7.95
TMS34008	1.75	2752A	9.95
MM5026	2.50	2752B	9.95
MM5057	2.50	2752C	9.95
MM5080	2.50	2752D	9.95
CRYSTALS		WIRE WRAP	
2000	6.144	100' ...	\$1.40
3000	8.000		
3579	10.000		
4000	18.000		
5000	18.432		
6000	20.000		
3.50 ea.			
DISC CAPACITORS		PRINTED CIRCUIT BOARD	
.1UF 16V	10/11	4" x 6" DOUBLE SIDED EPOXY BOARD 1/16" THICK	\$5.00 ea.
.01UF 35V	16/11	5" x 6" THICK	\$5.00 ea.
TOGGLE SWITCHES		FLAT RIBBON CABLE	
1080 - SPDT - 1.00		28 gauge	
2080 - DPDT - 1.40		40 conductor	
208P - DPDT - CENTER-OFF 1.80		50 conductor	
IN4148 (IN914)		WIRE WRAP SOCKETS	
15/1.00		14 PIN	.45
1411-IR DETECTOR	3/1.00	16 PIN	.50
FP 100 PHOTO TRANS	8/1.00	18 PIN	.65
RED LED's 2"	8/1.00	20 PIN	.90
RED, GREEN or AMBER LARGE LED's 2"	6/1.00	24 PIN	1.10
RED-RED BIPOLAR LED	.90	28 PIN	1.25
RED-YELLOW BIPOLAR LED	.90	40 PIN	1.80
MLED2 IR LED	.40		
MRD148 PHOTO DARL. XTOR	.50		
MCT72 OPTO ISOLATOR	.60		
4N28 OPTO ISOLATOR	.40		
1 WATT ZENERS: 3.3, 4.7, 5.1, 5.6, 6.8, 8.2, 9.1, 10, 12, 15, 18, or 22V	6/1.00		
DIP SWITCHES		20KV DIODES	
CTS 206-4 4 POSITION	.75	250 ma.	\$1.95
CTS 206-7 7 POSITION	.95		
CTS 206-8 8 POSITION	.95		
CTS 206-10 10 POSITION	1.25		
DIP SOCKETS		DB CONNECTORS	
20 PIN	.25	DB9P - 82.00	DB25F - \$2.40
8 PIN	.10	DB9S - 3.00	DB25S - 3.20
14 PIN	.15	HOODS - 1.10	HOODS - 1.10
16 PIN	.18		
24 PIN	.25		
18 PIN	.20		
40 PIN	.40		

POSTAGE RATES  
ADD 10% FOR ORDERS UNDER \$25.00  
ADD 5% FOR ORDERS BETWEEN \$25.00 & \$50.00  
ADD 3% FOR ORDERS ABOVE \$50.00



**SOLID STATE SALES**  
P.O. BOX 74D  
SOMERVILLE, MASS. 02143

TERMS: FOB CAMBRIDGE, MASS. SEND CHECK OR MONEY ORDER. MINIMUM TELEPHONE. C.O.D. PURCHASE ORDER OR CHARGE \$20.00. MINIMUM MAIL ORDER \$5.00.

SEND \$25 FOR OUR CATALOG  
FEATURING TRANSISTORS & RECTIFIERS. 145 HAMPSHIRE ST., CAMBRIDGE, MASS. 02139

TEL. (617) 547-7053

WE SHIP OVER 95% OF OUR ORDERS WITHIN 24 HOURS OF RECEIPT

TOLL FREE 1-800-343-5230  
FOR ORDERS ONLY

CIRCLE 23 ON FREE INFORMATION CARD

SCR's			TRIAC's		
1.5A	6A	35A	PRV	1A	10A 25A
100	.35	.40	1.40	100	.35 .60 1.40
200	.40	.50	1.80	200	.50 .80 1.90
400	.60	.70	2.40	400	.70 1.00 2.60
600		1.00	3.60	600	1.00 1.20 3.60
C/MOS			TTL IC SERIES		
4001	.40	4028	.80	4077	.50
4002	.40	4029	1.00	4081	.40
4008	.80	4030	.80	4082	.40
4007	.40	4034	1.75	4083	1.40
4008	.70	4035	1.00	4089	1.75
4009	.50	4040	1.00	4501	.35
4010	.60	4042	.90	4515	1.50
4011	.45	4043	.90	4516	1.00
4012	.45	4044	.90	4517	1.00
4013	.60	4046	1.20	4518	1.25
4014	.70	4047	1.50	4519	1.50
4015	.60	4048	.80	4519	1.75
4016	.80	4050	.80	4518	1.00
4017	1.00	4051	1.08	4520	1.20
4018	.70	4052	1.00	4520	1.15
4019	.70	4053	1.00	4520	1.15
4020	.80	4054	1.00	4520	1.15
4021	.80	4056	.70	4520	1.15
4022	1.00	4058	.50	4520	1.15
4023	.40	4059	.50	4520	1.15
4024	.70	4070	.50	4520	1.15
4025	.40	4071	.50	4520	1.15
4026	.95	4072	.50	4520	1.15
4027	.80	4076	.65	4520	1.15
74S SERIES			74LS SERIES		
74S00	.40	74S86	.90	74LS169	1.75
74S02	.40	74S89	1.90	74LS174	1.40
74S03	.40	74S112	.85	74LS174	1.40
74S04	.50	74S133	.50	74LS182	1.75
74S05	.50	74S135	1.10	74LS194	1.10
74S08	.50	74S138	1.25	74LS195	1.50
74S10	.40	74S139	1.10	74LS200	1.50
74S11	.45	74S140	1.70	74LS241	1.50
74S15	.50	74S151	1.25	74LS257	1.30
74S20	.45	74S153	1.10	74LS259	1.30
74S30	.40	74S157	1.25	74LS280	1.50
74S32	.50	74S158	1.25	74LS280	1.75
74S34	.90	74S161	1.75	74LS373	2.25
		74S163	1.40	74LS374	1.75

LINEAR CIRCUITS			
DAQ08EQ	3.75	LM370	1.60
TL062 CP	.95	LM377	1.60
TL064 CN	1.50	LM380	1.20
LM201	.75	LM384	1.60
LM301/748	.30	LM386	1.20
LM307	.30	LM387	1.25
LM308	.85	LM393	.75
LM310	1.10	LM355	.50
LM311	.50	LM356	.90
LM318	.95	568	3.50
LM319	1.30	565	1.25
LM324	.55	566	1.25
LM329	.90	567	2.50
LM348	.90	709C	.35
LF351	.55	LM710	.60
LF355	.90	711CH	.40
LF356	1.00	733	.95
LM358	.80	741VC	.40
LM381	1.75	747	.50
		CA758	1.75
		LM1310	1.60
		LM458	.80
		LM458	.50
		LM1808	1.75
		LM2901	.95
		CA3018	1.96
		CA3078AT	1.50
		CA3086	.75
		AD7200L	1.75
		AD7200LD	1.49
		CA3140	1.40
		3900	.50
		LM3909	.80
		4136	.85
		N5866A	1.50
		D6333B	1.75
		LM1300	.35
		LM13090	.35
		8700CJ	5.95

FULL WAVE BRIDGE		
PRV	2A	6A 25A
100	.40	1.40
200	.80	1.30
400	1.00	1.65
600	1.30	1.90

SILICON POWER RECTIFIERS		
PRV	1A	3A 12A 50A 125A 240A
100	.05	.14 .35 .90 5.00 6.00
200	.08	.17 .50 1.30 7.00 9.00
400	.09	.25 .65 1.50 10.00 12.00
600	.11	.30 .80 2.00 13.00 15.00
800	.13	.35 1.00 2.50 16.00 18.00
1000	.20	.45 1.25 3.00 20.00 25.00

1000	.20	.45	1.25	3.00	20.00	26.00
<b>REGULATORS</b>						
LM338K	.....	\$5.75	323K (LA1405)	.....	\$1.75	
LM317T	.....	\$1.35	LM305G	.....	\$ .75	
78L05, 78L12	.....	\$ .40	340T-5, 6, 8, 9, 12,			
723	.....	\$ .50	15, 18 or 24V	.....	\$ .75	
320T 5, 12, 15 or 24	.....	\$ .85	LA1412 + 12V			
LM 337T	.....	\$1.95	3A	.....	\$3.95	

TANTALUM CAPACITORS			
.22UF 35V	5/\$1.00	15UF 16V	3/\$1.00
.47UF 35V	5/\$1.00	30UF 6V	5/\$1.00
.68UF 35V	5/\$1.00	33UF 15V	\$ .50
1UF 20V	5/\$1.00	47UF 20V	\$ .85
2.2UF 20V	5/\$1.00	68UF 16V	\$1.00
3.3UF 20V	4/\$1.00	120UF 6V	\$ .75
4.7UF 35V	4/\$1.00	200UF 20V	\$1.75
6.8UF 20V	4/\$1.00	150UF 16V	\$1.30
10UF 20V	— \$ .40	330UF 10V	\$1.75
22UF 20V	— \$ .30		

EPOXY GLASS VECTOR BOARD	
1/16" thick with 1/10" spacing	4 1/2" x 6 1/2" ..... \$1.95
14 PIN HEADERS	3/1.00
16 PIN HEADERS	.40
24 PIN HEADERS	.75
40 PIN HEADERS	1.10
50 PIN EDGEBOARD CONN.	3.95
40 PIN EDGEBOARD CONN.	3.00
50 PIN ANGLE CONN.	3.95
TRANSISTOR SPECIALS	
2N1307 PNP GETO-5	.40
2N4044 PNP GETO-5	3/1.00
HEP 68014 - PNP GETO-3	.85
TIP 111	.50
2N2333 NPN SWITCHING POWER	.85
MRP-8004 CM RF TRANSISTOR NPN	.75
2N3772 NPN Si TO-3	.80
2N4908 PNP Si TO-3	.80
TIP 2865 PNP Si	.70
2N2222 NPN Si TO-18	7/1.00
2N2907 PNP Si TO-18	7/1.00
2N3055 NPN Si TO-3	.80
2N3804 NPN Si TO-18	7/1.00
2N3904 NPN Si TO-18	7/1.00
2N4349 PNP Si TO-18	.85
TIP 318 NPN Si TO-220	.40
TIP 328 PNP Si TO-220	.40
TIP 36 PNP Si	.40
TIP 121 PNP Si U84	.80
TIP 141 NPN Si U87	.80
2N2857 NPN Si TO-18	.85
DPS2000 - DUAL POWER DARL.	.85
MJE3055T	.80

TTL IC SERIES			
7400	.30	7474	.50
7401	.30	7475	.50
7402	.30	7476	.50
7403	.30	7480	.45
7404	.30	7483	.50
7405	.30	7485	.70
7408	.30	7486	.55
7409	.30	7490	.50
7410	.30	7491	.55
7411	.30	7492	.55
7412	.30	7493	.55
7413	.45	7494	.60
7414	.60	7495	.55
7416	.75	7496	.60
7417	.75	7497	.50
7420	.30	74107	.50
7421	.30	74116	1.50
7426	.30	74121	.45
7427	.30	74122	.55
7428	.30	74123	.55
7430	.30	74125	.60
7432	.40	74126	.45
7437	.50	74145	.60
7438	.90	74148	1.10
7440	.30	74150	1.10
7441	.75	74151	.60
7442	.60	74153	.60
7445	.80	74154	1.60
7446	.80	74155	.60
7447	.80	74157	.60
7448	.80	74160	.85
7450	.30	74161	.65
7472	.40	74162	.70
7473	.45	74163	.70
		74164	.80
		74165	.80
		74166	.90
		74170	1.60
		74173	.75
		74174	.65
		74175	.70
		74176	.75
		74180	1.80
		74181	.85
		74182	.90
		74190	.80
		74192	.80
		74193	.79
		74194	.85
		74195	.45
		74196	.55
		74221	1.00
		74273	.85
		74279	.60
		74298	.65
		74365	.80
		74367	.80
		74390	.90
		74392	1.75
		75492	1.05
		9601	.75
		9602	.75
		8726	1.40
		8728	1.40
		8797	1.10
		8798	1.10

74LS SERIES			
74LS00	.40	74LS109	.55
74LS01	.40	74LS112	.50
74LS02	.40	74LS113	.60
74LS03	.40	74LS114	.65
74LS04	.50	74LS123	.85
74LS05	.50	74LS125	1.00
74LS06	.50	74LS126	.60
74LS09	.50	74LS128	.75
74LS10	.40	74LS136	.50
74LS11	.40	74LS137	.55
74LS12	.40	74LS138	1.25
74LS13	.55	74LS139	1.49
74LS14	.70	74LS147	1.95
74LS15	.50	74LS151	.70
74LS20	.40	74LS153	.70
74LS21	.40	74LS154	2.40
74LS22	.40	74LS155	.80
74LS23	.55	74LS156	.80
74LS27	.55	74LS157	.80
74LS28	.50	74LS158	.80
74LS30	.40	74LS160	.90
74LS32	.75	74LS161	.90
74LS37	.50	74LS162	.90
74LS38	.50	74LS163	.90
74LS40	.40	74LS164	.90
74LS41	.65	74LS165	.90
74LS47	.50	74LS166	1.00
74LS51	.40	74LS169	2.50
74LS54	.40	74LS170	1.90
74LS73	.50	74LS173	.90
74LS74	1.00	74LS174	.90
74LS75	1.25	74LS175	.90
74LS76	.55	74LS181	1.95
74LS83	.40	74LS190	1.90
74LS86	.90	74LS191	.90
74LS86	.90	74LS192	.90
74LS80	.80	74LS193	.90
74LS92	.70	74LS194	.90
74LS93	.70	74LS195	.90
74LS96	.80	74LS196	.90
74LS107	.55	74LS197	.90
		74LS221	1.50
		74LS240	1.50
		74LS241	1.50
		74LS243	1.50
		74LS244	2.25
		74LS245	3.25
		74LS246	.95
		74LS247	1.50
		74LS248	1.60
		74LS251	.70
		74LS253	.70
		74LS257	.70
		74LS258	.80
		74LS259	1.00
		74LS260	.70
		74LS272	1.60
		74LS276	.80
		74LS280	1.60
		74LS283	.80
		74LS290	.90
		74LS293	.90
		74LS296	1.20
		74LS320	2.00
		74LS323	3.50
		74LS330	1.00
		74LS366	.90
		74LS367	1.25
		74LS368	.90
		74LS373	2.00
		74LS374	2.00
		74LS377	1.50
		74LS386	.60
		74LS390	1.10
		74LS393	1.00
		81LS197	1.50
		81LS298	1.50

MULTI TURN TRIM POT		
50 OHM		5K
100 OHM	3/\$2.00	10K
1000 OHM		50K





# FORMULA INTERNATIONAL INC.

12603 Crenshaw Blvd., Dept. B, Hawthorne, CA 90250

For information (213) 973-1921 • Orders Only (outside Calif.) (800) 672-8758



## POCKET LIGHT

Complete with 5" fluorescent tube, powerful bulb and handy strap. Runs on 3 pcs 1.5V "C" size batteries (not included). It's a practical, convenient, powerful spotlight and fluorescent light. Its superior quality is ideal for indoor or outdoor use.

**LOW PRICE \$6.50**

## SANYO UHF VARACTOR TUNER

FOR UHF CHANNELS 14-83

Tuning voltage +1 to +28VDC. Input impedance 75Ω. IF band width 7-16MHz. Size 2 1/2" x 1 1/4" x 3/4". Supply voltage 15VDC.

Model 115-B-403A, Video IF 45.0MHz  
Model 115-B-405A, Video IF 62.5MHz

**\$19.95**

Tuner is the most important part of the circuit. Don't let those \$19.00 tuners fool you. All units are brand new from Sanyo. When ordering please specify model number.



## MARK IV — 15 STEP LED POWER LEVEL INDICATOR KIT

This new stereo indicator kit consists of 36 4-color LED's (15 per channel) to indicate the sound level output of your amplifier from -36dB to +36dB. Comes with a well designed silk screen printed plastic panel and has a selector switch to allow floating or gradual output indicating. Power supply is 6-12VDC with THG on board input sensitivity controls. This unit can work with any amplifier from 1W to 200W. Kit includes 70 pcs driver transistors, 38 pcs matched 4-color LED's, all electronic components, PC Board and front panel.

**MARK IV KIT \$31.50**



## FLOURESCENT AUDIO LEVEL MONITOR

This is the kind of VU monitor that is being used by most amplifier manufacturers. IC's are used to simplify circuit layout. Easy to assemble and can be used with all power level amplifiers. Power requirement 12VDC.

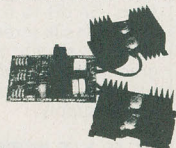


**TE-221 KIT**  
**For Just \$28.50**  
(Limited Stock)

## TA-1000

**KIT**  
**\$51.95**

**Power Transformer**  
**\$24.00 ea.**



## 100W CLASS A POWER AMP KIT

Dynamic Bias Class "A" circuit design makes this unit unique in its class. Crystal clear, 100 watts power output will satisfy the most picky fans. A perfect combination with the TA-1020 low TIM stereo pre-amp.

Specifications • Output power 100W RMS into 8Ω. 125W RMS into 4Ω • Frequency response 10Hz-100KHz • THD less than 0.01% • S/N ratio better than 80dB • Input sensitivity 1V max. • Power supply ±40V at 5A.

## 1 WATT AUDIO AMP

All parts are pre-assembled on a mini PC Board. Supply voltage 6-9VDC. **Special Price \$1.95**

## 6W AUDIO AMP KIT

TBA810 with Volume Control. Power Supply 6-18VDC **Only \$7.50 ea.**

## "FISHER" 30 WATT STEREO AMP

MAIN AMP (15W x 2). Kit includes 2 pcs. Fisher PA 301 Hybrid IC, all electronic parts with PC Board. Power supply ±16VDC (not included). Voltage gain 33dB, 20Hz-20KHz.

**Super Buy Only \$18.50**



## LASER SUPER LATERN

Brilliant fluorescent lantern with 9" 6 watt fluorescent tube. Features include. Powerful direct beam spotlight with 9V pre-focus bulb; Buzzer horn - either constant or time intervals of sonic alarm; Twin blinker - red amber flashing or red & amber flashing on time intervals; Fully adjustable nylon strap. Operates from D size batteries or plugs into vehicle cigar lighter socket.

**SPECIAL \$11.95**

## 6-WAY A/C ADAPTOR

Input: 110VAC. Output: 3V, 4.5V, 6V, 7.5V and 12VDC. Current: 300mA.

**OUR LOW PRICE**  
**\$5.50 ea.**

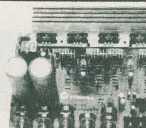
No FCC License Required  
**OUR PRICE \$49.50**  
Additional Microphone (Transmitter) Available at \$28.00 ea.  
**MURA WMS-49**

## CRYSTAL CONTROLLED WIRELESS MICROPHONE SYSTEM

Transmitter: FET mic for flat 30Hz-18KHz response. X'tal controlled 49MHz AM Band for drift-free performance. 100mW output (range approx. 1/4 mile) for reliable long range transmission. Powered by a 9V radio battery.



Receiver: X'tal controlled locks on 49MHz transmitter signal. On panel VU meter, monitors the signal strength from the microphone. Standard phone jack outlet connection to a P.A. or other phone input. 9V battery included. This professional set is ideal for on stage, in field, church, in house or outdoor use.



**A GOOD BUY**  
**at \$65.00**  
**TA-800**

## 120W PURE DC POWER STEREO AMP KIT

Getting power hungry from your small amp? Here's a good solution! The TA-800 is a pure DC amplifier with a built-in pre-amp. All coupling capacitors are eliminated to give you a true reproduction of the music. On board tone and volume controls combined with built-in power supply make the TA-800 the most compact stereo amp available. Specifications: 60W x 2 into 8Ω. Freq Range: 0Hz-100KHz ±3dB. THD: .01% or better. S/N Ratio: 80dB. Sensitivity: 3mV into 47K. Power Requirement: ±24-40 Volts.

## WHISTLE ACTIVATED SWITCH BOARD

All boards are pre-assembled and tested. You whistle to its FET condenser microphone from a distance, as far as 30 feet away (sensitivity can be easily adjusted), and it will turn the switch on. If you whistle again it will turn off. Ideal for remote control toys, electrical appliance such as lights, coffee pots, TV, Hi-Fi, radio or other projects. Unit works on 9VDC.

**Model 968 .....\$2.50 ea.**

## LOW TIM DC STEREO PRE-AMP KIT TA-1020

Incorporates brand-new DC design that gives a frequency response from 0-100KHz ±0.5dB. Added features like tone defeat and loudness control let you tailor your own frequency supplies to eliminate power fluctuations!

Specifications: • THD/TIM less than .005% • Frequency response DC to 100KHz ±0.5dB • RIAA deviation ±0.2dB • S/N ratio better than 70dB • Sensitivity: Phone 2mV 47KΩ, Aux 100mV 100KΩ • Output level 1.3V • Max output 15V • Tone controls: Bass ±10dB @ 50Hz, Treble ±10dB @ 15Hz • Power supply ±24VDC @ 0.5A. Kit comes with regulated power supply. All you need is a 48VCT transformer @ 0.5A.

**Only \$44.50**  
**Transformer**  
**\$4.50 ea.**



## UNIVERSAL NI-CD BATTERY CHARGER MW-398

Charges 9V, AA, C or D size Ni-CD batteries all at one time.

**Part No. 050-0190 \$11.50 ea.**

## SUPER FM WIRELESS MIC KIT

This new designed circuit uses high FREQ FET transistors with 2 stage pre-amp. Transmits FM range (88-120MHz) up to 2 blocks away and with the ultra sensitive condenser microphone that comes with the kit allows you to pick up any sound within 15 ft. away. Kit includes all electronic parts, OSC coils and PC Board. Power supply 9VDC.

**FMC-105 \$11.50 per Kit**

## PROFESSIONAL FM WIRELESS MICROPHONE

Made by one of the leading Japanese manufacturers. This factory assembled FM wireless microphone is powered by two AA size batteries. It transmits in the range of 88-108MHz. Element is built in a plastic tube type case with an omni-directional electronic condenser microphone unit. By using a standard FM radio, signal can be heard anywhere on a one acre lot. Sound quality was judged "very good." MODEL WEM-36 was \$16.50.

**ON SALE \$8.25 ea.**

## HEAVY DUTY 500mA MULTIPLE AC-DC ADAPTOR

For all battery operated electronic equipment up to 500mA with LED indicator.

Input: 117/220VAC, 50/60Hz

Output: 3, 4.5, 6, 7.5, 9 and 12VDC.

**Model SA-8112A**  
**\$25.00 ea.**

## SANYO ANTENNA SIGNAL BOOSTER

This Booster is specially designed for UHF Channels (14-83). After installing (between the antenna input cable and the UHF tuner), this unit will provide a minimum of 10dB gain, that is approximately 2 times better than you are seeing now. Ideal for those who live in apartments that can not put up an outdoor antenna. Small in size, only 2" x 1 1/2" x 1". Supply voltage is 15 VDC.

**Model 001-0076**

**\$12.50**

## PROFESSIONAL REGULATED VARIABLE DC POWER SUPPLY KIT

All solid state circuitry with high efficiency power transistor 2SD388 and IC voltage regulator MC1733. Output voltage can be adjusted from 0-30V at 1A current limited or -15V at 2A current limited. Internal resistance is less than 0.005Ω, ripple and noise less than 1mV, dual on panel meters for voltage and current reading, also with on board LED and audible over load indicator. Kit comes with pre-drilled PC Board, instructions, all necessary electronic components, transformer and a professional looking metal cabinet. The best project for school and the most useful instrument for repairmen. Build one today!



**Model TR88A**  
**0-15VDC @ 2A**

**Model TR88B**  
**0-30VDC @ 1A**

**\$59.50 per Kit**



## TA-322 30 WATTS TOTAL 15W + 15W STEREO AMP KIT

This is a solid state all transistor circuitry with on board stereo pre-amp for most microphone or phone input. Power output employs a heavy duty Power Hybrid IC. Four built on board controls for, volume, balance, treble and bass. Power supply requires 48VCT 2.5A transformer. THD of less than 0.1% between 100Hz-10KHz at full power (15 Watts + 15 Watts loaded into 8Ω).

**\* SPECIAL \***  
**Excellent Price!**  
**Model 001-0034**  
**\$29.50 per Kit**  
**Transformer**  
**\$10.50 ea.**

## LOW T.I.M. TRANSISTORS 100W + 100W

• Employs Hitachi low noise I.C. for pre-amp • Max. output 16 V P-P (non distortion) • With hi-low filter, and tone defeat circuit • Rear power amp with short circuit protection • Giant heat sink for maximum results • Tone controls ±14dB • All components (except pots for volume, and tone controls) are pre-assembled, the quality is guaranteed. • Power supply DC ±35V-50V

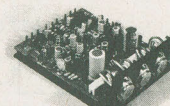


**MODEL: SA802C**  
**Part #370-0340 .....\$85.00**  
**POWER TRANSFORMER**  
**(68V-80V CT 6 AMP)**  
**Part #670-0220 .....\$24.50**

## 60W + 60W O.T.L. AMP

Stereo pre-amp + tone control + power amp. All in on unit, fully assembled! Compact in size: 7"x4 1/2"x2 1/2". Can be fitted into most cabinets. Power transistors using 25C1667 X 4 to give a max output of 60W + 60W (8Ω)

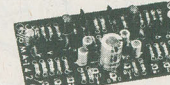
• Frequency response: 20Hz - 85KHz (-1dB) • Total harmonic distortion: 0.02% (1KHz) • Signal/Noise Ratio: 88 dB (open loop) • Tone control: 100 Hz ±16 dB 10 KHz ±14dB • Dynamic range: 60 dB • Power Supply: 48V - 70V 5amp. • Filter Capacitor: 4700µF 75V or better.



**MODEL: SA-4520**  
**Part #370-0350 .....\$39.95 ea.**  
**1 Transformer Part #670-0230 ... \$22.50 ea.**  
**2 Filter Capacitor 4700µF 70V \$6.50 ea.**

## MAGNETIC HEAD EQUALIZER

• Standard RIAA curve for all kinds of magnetic heads • 3 stages crossover circuit for best results • Output voltage guaranteed to be stable without any oscillation • Power Supply: 24 V.D.C.



**MODEL: MA-142**  
**Part #370-370 .....\$6.95 ea.**

## STEREO MIC. AND ECHO MIXER FOR STEREO AMPLIFIER SYSTEM

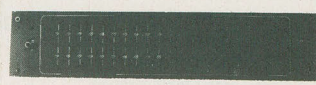
The circuitry employs all integrated circuits, BBD type echo circuit, echo time can be adjusted (max. .30 Msec.) Also with a microphone preamp on the board. Fully assembled.



**MODEL: MX205**  
**Part #370-0360 .....\$29.95 ea.**

## 20 STEPS BAR/DOT AUDIO LEVEL DISPLAY KIT

This new designed audio level display unit is using a new integrated circuit from National Semiconductor to drive 20 pieces of color LEDs (green, yellow and red) on each channel. It provides two types of display methods for selection "bar" or "dot". The display range is from -57dB to 0dB. Kit is good for any amplifier from 2 watt to 200 watts! Power supply requires 12V AC or DC. So it is great for cars as well! Kit comes with printer circuit board, all LEDs, electronic components, switches, and silk screen printed professional front panel.



**MODEL: TY-45**  
**Part #370-0280 .....\$38.50**

SEND ONE DOLLAR FOR OUR DETAIL CATALOG

Inside California  
Outside Calif. (incl. Mexico & Canada)  
Overseas

Shipping & Handling Charges	
Under \$50.00	Over \$50.00
Purchase	Purchase
10%	5%
15%	10%
25%	20%

Minimum Order \$10.00/Calif. Residents add 6.5% Sales Tax. Phone Orders Accepted on VISA or MC ONLY. NO C.O.D.'s. Prices subject to change without notice.

\*Apple and Apple II are the trademark of APPLE COMPUTERS, INC.

CIRCLE 76 ON FREE INFORMATION CARD

**STORE HOURS**  
**MON-FRI-10-7**  
**SAT-10-6**





# SEI, INC.

641 Academy Drive • Northbrook, Ill. 60062 • (312) 564-0104



## THE SOLUTION COMPUTER

An Affordable 64K Assembled Computer With These Features:



- Fully compatible with Apple® II +
- Original design!
- Fully assembled and tested!
- Detachable keyboard for easy use, upper lower case.
- Uses 64K x Dynamic Ram
- 9 on board peripheral connectors for expansion.
- Uses 6502 mpu.

**\$675.00 each (Monitor not included)**

The Solution Computer is the answer for people who realize a great product when they see one. Many other peripheral card products are available for the Solution Computer. Send for a free color brochure today.

## APPLE II® COMPATIBLE SLIM DISK DRIVE

**RUNS QUIETER THAN THE ORIGINAL!**

New - guaranteed! Only 6" w x 1 1/4" h x 10" d. Complete with a 3' cable. Runs with Apple controller or our optional controller.



**Now only \$224.95**

## SOLID STATE STEREO GRAPHIC EQUALIZER PRE AMP KIT TA-2500



**Specifications:** • Total Harmonic Distortion: Less than 0.05% • Intermodulation Distortion: (70Hz: 7KHz = 4:1 SMPTE Method) Less than 0.03% • Frequency Response: Overall 10Hz ~ 100KHz +0.5db. -1dB. • RIAA Curve Deviation: (Phono) +0.2dB. -0.2dB (30Hz ~ 15KHz) • Channel separation (at rated output 1 KHz) • Phono. Tuner. Aux and Tape Monitor better than 70dB. • Input sensitivity and impedance (1KHz for rated output)

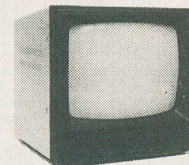
**Phono:** 2MV 47K ohms **Aux:** 130MV 50K ohms **Tuner:** 130MV 50K ohms **Tape:** 130MV 50K ohms. **Graphic Equalizer control:** 10 Band Slide Control. **Frequency Bands:** 31 5Hz: G3Hz: 125Hz: 250Hz: 500Hz: 1KHz: 2KHz: 4KHz: 8KHz: 16KHz also with on panel selector for Phono. Tuner. Aux 1 and Aux 2. **Power Supply:** 117 VAC

Kit comes with all electronic components, transformer, instructions and a 19" rack mount type metal cabinet.

**MODEL TA-2500**

**\$119.00 PER KIT**

## MONITOR (12")



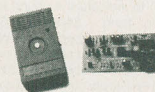
- Orange amber screen
  - 18 MHz bandwidth
  - High resolution graphics
- Composite video 1/0 75/10K ohm impedance. A phenomenal quality monitor for your computer. 110 VAC.

**MON-1 ..... \$119.95**

## APPLE II PERIPHERAL CARDS

- 80 column card ..... \$109.95
- 16 Ram card ..... \$44.50
- Z80 cpm card ..... \$99.95
- Disk controller card ..... \$59.95
- Eprom writer card ..... \$84.95

## INFRA-RED REMOTE CONTROL SWITCH KIT

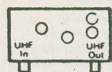


Infra-red Remote Control switch can be used to control appliances up to 500 W. The TK-41 has effective control up to 10 meters.

No antenna needed. Features latest IC controller which excludes interferences from light or AC pulse signal.

**TK-41 Kit ..... \$24.95**

## UHF TV PREAMP



**Features:**

- 25 dB gain!
- Kit

Your reception will dramatically improve! This unit will enable you to pull in signals you never knew were there!

For both indoor and outdoor use. Input and output impedance 75 ohm. No adjustment! Easy assembly.

**JH-0 Kit ..... \$23.95**

## R.F. MODULATOR



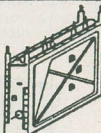
Combine both audio and video output onto channel 3 or 4 of your T.V. set.

Single J.C. chip (MC 1374) makes for quick and easy assembly. Single adjustment control! A must for every video recording or computer enthusiast.

**VH-0 Kit ..... \$19.95**

## PHILIPS VARACTOR TUNER

Comes with adaptor board to directly replace Mitsumi tuner! Can use this with any board drilled for Mitsumi! High gain and phenomenal picture quality.



**SPECIFICATIONS:** • Freq. Range: 470-899 mHz • Output: Channel: 3 • Input: 75 ohm • Gain: 18 dB

**ELC 1045 ..... \$23.95**

## DIGITAL MULTIMETER



- 3 1/2 digit LCD meter
- Input impedance 20 Ohm
- hFE measurement
- DC .5% accuracy
- DCA up to 10 amps
- Leads and battery included

**MIC-3300A ..... \$59.95**

**Carrying Case ..... \$ 9.95**

## TTL/CMOS LOGIC PROBE

- 4 LED states
- Pulse memory
- Supply Voltage 3 ~ 18 VDC
- TTL CMOS checking made easy!

**L101A ..... \$34.95**

## LOGIC PULSAR PROBE

- Easily repair logic circuits
- 5Hz or 500Hz signal
- External Sync Input
- Supply Voltage 3 ~ 18 VDC

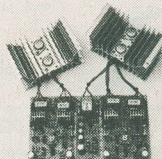
**L201A ..... \$34.95**

## TA-802 160 WATT TOTAL 80W + 80W STEREO AMP KIT

This is a solid state all transistor circuitry on board stereo amplifier. Power output employs 2 pairs of matching Darlington transistors. T.H.D. less than .05% between DC to 200 KHz. Pwr supply requires 30 VCT 2 amp x FMR.

**TA-802 \$39.95**

**Transformer (optional) \$9.95 ea.**



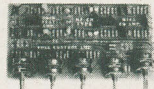
## FOR INFORMATION CALL (312) 564-0104

## LOW TIM DC STEREO PRE-AMP KIT TA 2800

Incorporates state of D.C. design that gives a frequency response from 0Hz-100KHz ± .5dB. • Features tone defeat switch, loudness, treble, midrange, bass, balance. • TA-2800 contains quad BiFet op-amp to develop T.H.D. of .005% at rated output • Input sensitivity: phone 2.5 MV tuner, aux, tape play 100MV/100K • Power supply ± 15 volt DC at .2A. Kit comes with regulated power supply, all you need is a 15-20 VCT .2 amp. XFMR.

**Only \$44.50**

**XFMR \$4.50 ea.**



## AMATEUR MICROWAVE RECEIVER KIT 1.9-2.5 GHz

**PS-1 Assembled 32 element antenna \$19.95**  
**PS-2 20 dB gain microwave receiver kit with variable power supply kit ..... \$50.00**  
**PS-3 Complete package PS-1 & 2 ..... \$65.00**

**MOUNTING HARDWARE INCLUDED**

## MICROWAVE PREAMP! NEW KIT

Use with PS-3 Kit. Adds 20-25 dB gain to boost reception distance.

- Low Noise
- High Gain
- Can be used with all existing stop sign board receivers!
- 1.9-2.5 GHz freq. range

**PS-4 (Kit) ..... \$34.95**

## TO ORDER OUTSIDE ILLINOIS:

## SOLID STATE STEREO REVERBERATION AMPLIFIER

### Specifications:

- Total harmonic distortion less than .05%
- Frequency response 10 Hz to 50KHz ±1dB
- S/N Ratio 90dB
- Reverberation time 1 to 3 sec
- Input 150MV/50K ohm
- Max. input 2V
- Accepts input from tape, phono, or aux.

Includes an LED Reverb Level display. Kit comes with all electronic components, transformer and instructions, and 19" rack mount cabinet.

**Model TA-2400 ..... \$89.95**

## SPY EAR!

A very popular device designed to listen to sounds & voices through rooms or 3 ft. thick concrete walls. Place listening sensor against wall and earphone in ear. Adjust volume control! Hear clearly to things you might not want to!



**CM-8 ..... \$89.95**

## CALL TOLL FREE 1-800-323-1327

## TY-45 20 STEP LED

## POWER LEVEL INDICATOR KIT

This new stereo level indicator kit consists of 40 3-color LED's to indicate sound level output of your amplifier from -57 dB to 0 dB. Comes with an attractive silk screen printed panel. Has selector switch to allow floating or gradual output indicating. Kit includes all parts, Front panel and power supply.

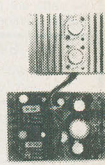
**TY-45 KIT**

**\$34.95**

## MICRO COMPUTER POWER SUPPLY TR-626

The TR-626 is a power regulator for use with popular microcomputer circuits. Features:

- ±5V 6A
- -5V .5A
- +12V 1.5A
- -12V .5A



Each unit contains current limit protect circuit and two Darlington power transistor on a heatsink. Transformers included.

**\$39.95 each**

Minimum order \$15.00. Add 10% shipping on orders under \$35.00. Orders over \$35.00, add 5%. Catalog - \$1.00. Visa & Mastercharge acceptable.

CIRCLE 55 ON FREE INFORMATION CARD



## APPLE IIe 64K RAM CARD

80 column x 24 lines

**64K RAM**

Compatible with  
Apple IIe Software

**\$149<sup>00</sup>**

## PARALLEL INTERFACE EPSON TO APPLE

New From **\$49<sup>95</sup>** CABLE INCLUDED  
COEX

## 5 1/4" Floppy DISKETTES

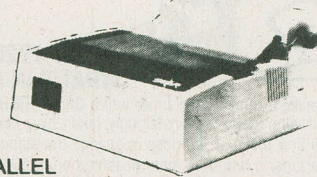
All Certified—100% Guaranteed

BOX of 100 ... **\$149<sup>00</sup>**  
Above with  
Hub Rings ... **\$169.00**

**BMC 12" Green Monitor** **\$95<sup>00</sup>**

## COEX 80-FT DOT MATRIX PRINTER

- 9x7 Dot Matrix, 80 CPS, Bi-Directional Printing
- 2K Buffered Memory
- 80, 96, 132 Columns, Graphics and Block Printing
- Selectable Char Pitch, Line Spacing and Feed



PARALLEL  
COEX Interface Card to Apple .. **\$49.95**  
Commodore Interface Card to  
VIC, 64, PET ..... **\$79.95**

**\$240<sup>00</sup>**

for **APPLE**  
**16K RAM CARD**  
Language Transparent  
COEX FACTORY WARRANTY **\$49<sup>95</sup>**

## EXTENDER CARDS

for APPLE... **\$16.95**  
for I.B.M.... **\$19.95**

## FLOPPY DISK DRIVE

*Apple IIe Compatible*

- with • Track Zero Micro Switch
- DOS 3.2.1 & DOS 3.3
- CP/M and PASCAL

DESIGNED  
FOR YOUR **\$235<sup>00</sup>**  
APPLE™ .....  
Controller Card  
for above ..... **\$75.00**

## DO YOU HAVE A COMMODORE?

**NEW ROM for COEX 80 & DP8480**  
Allows Full Graphics Compatibility  
with All Commodore Computers **\$29<sup>95</sup>**

## Now You Can Afford Another 64K...

**Especially when it's less than  
a half cent per bit!**

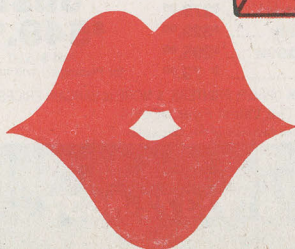
### Specifications:

- Fully Static Operation
- Supports S-100 IEEE-696 Standards
- Uses Popular 2716 Pinout Type Static RAM's
- Board Access Time Under 200nS
- 150nS RAMS Standard
- No Wait States Needed at 6.000MHz
- High Quality FR-4 Type PC Board
- Switch Selectable Phantom Line
- All Data, Status and Address Lines Fully Buffered
- Gold Plated Contact Fingers for Low Contact Resistance and Long Life
- Switch Selectable Extended Address Lines For Up To 16 M-bytes
- Extreme Low Power Dissipation (<500mA Typical)
- Top 8K May Be Switched Disabled and/or Interchangeable with 2716 Type EPROM's

**COEX 64K S-100 CMOS**

**STATIC RAM BOARD**

**\$299<sup>00</sup>**  
only  
Assembled & Tested



"Have You Kissed Your Computer Lately?"

**Components Express, Inc.**

1380 E. Edinger • Santa Ana, Calif. 92705 • 714/558-3972

TWX 910-595-1565 • ADVACON SNA • International Orders Welcome

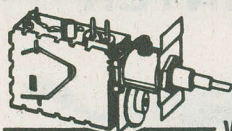
Terms of Sale: Cash, Checks, Credit Cards, M.O., C.O.D. Calif. residents add 6% sales tax.

CIRCLE 88 ON FREE INFORMATION CARD



# MORE GAIN

## Than a Varactor UHF Tuner



\$15<sup>00</sup>

**SATISFACTION GUARANTEED**

Frequency Range 470-899 MHz Channels  
14-83. Output Channel 3. Ch 2 or 4 Avail.

**PART #B20**  
**WHAT'S IN IT?**

\$15<sup>00</sup>

To make a regular UHF tuner into a **GILCO HIGH GAIN TUNER**, each and every one of the following steps is painstakingly taken by a certified technician:

1. The first thing GILCO does is change the standard diode to a **hot carrier diode**.
2. The tuner's output is then measured on our JERROLD field strength meter and compared to a computer derived chart from which we determine the correct value coil to add across the IF output for **maximum pre-peaked gain**.
3. The tuner is then fed a standard 10db 300 ohm antenna input and while monitoring the output on our HEWLETT PACKARD spectrum analyzer, the tuner is tuned to the desired channel and its oscillator is offset for the desired output frequency as follows:

Channel 2: 58 Mhz, Channel 3: 63 Mhz, Channel 4: 68 Hhz

We call this step peaking because the tuner's output looks like a peak on our spectrum analyzer and the highest point of that peak is actually adjusted for the desired output.

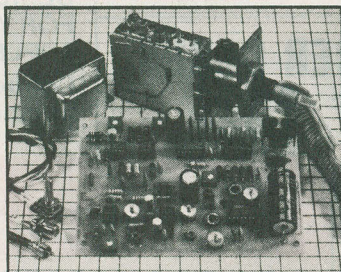
4. The last step is one more measurement on the field strength meter which is again compared to our performance chart to calculate the correct value of the second coil which is added to the tuners internal connections.

This procedure was developed by GILCO and it is our computer derived performance charts that make our tuner better, that's because **almost every tuner gets a different value coil** before it's peaked and again a different value coil after it's peaked. The combinations are endless and **the way we determine the values is our secret...**

### GILCO PARTS KIT & PRINTED CIRCUIT BOARD

- Use with GILCO High Gain Tuner
- Requires NO Modification to Your Television
- Individually Packaged and Labeled Parts Save Guesswork

- The only tools required for assembly are: screwdriver, soldering iron, voltmeter. No drilling is required to the P/C board.
- This kit was designed to take advantage of the GILCO high gain tuner which means its circuitry is **simpler and more efficient** than those circuits that require inferior varactor tuners.



Pre-drilled, pre-screened, plated through the holes P/C board. All hardware, connectors, 22 page illustrated instruction manual, & Gilco Hy-Gain tuner. Kit assembles in just 4 hours.

**FREE 22 Page Instruction Book** included with each P/C Board or Parts Kit. This instruction book will guide the builder through every step of the assembly. **Nearly every page is illustrated.** With this Instruction Book, estimated assembly time is 4 hours.

### HERE'S WHAT YOU GET FROM GILCO

**Part No. B21 Printed Circuit Board** ..... \$17<sup>00</sup>

1. This Printed Circuit Board uses **only one jumper, others use nine**.
2. **The component layout is screen printed** on the component side of the P/C board.
3. The solder side of the P/C board is covered with high temperature solder
4. **Newest Addition: the P/C board is plated through the holes.** This allows for easier and more positive soldered contact between the parts and the P/C board.

**Part No. B22 Complete Electronic Parts Kit** ..... \$80<sup>00</sup>

All resistors (30), Potentiometers (1-5K, 3-10K), Panel Mount Potentiometer (10K), Electrolytic Capacitors (6), Ceramic and Mylar Disc Capacitors (35), Variable Capacitors (4), All Integrated Circuits (7), Voltage Regulator, Heat Sink, Diodes (4), IC Sockets (4-8 pin, 3-14 pin), Power Transformer (24V, 1A), Coil Kit with No. 26 wire (4), Speaker (4", 3oz.), Standoffs, Coaxial Cable, All Miscellaneous Hardware, Etc. All parts are individually packaged and labeled.

All components including the Wire, Hardware, Coaxial Cable and Heat Sinks are included in the parts kit. This means your assembly time from start to finish is just 4 hours.

### GILCO ACCESSORIES & AMPLIFIER KITS

- #A02 New 2 stage, low noise, 28db gain, RF Amplifier Kit ..... Kit \$18<sup>00</sup>
- #A03 New 1 stage, low noise, 14db gain, RF Amplifier Kit ..... Kit \$10<sup>50</sup>

### GILCO ORDER FORM

- #B20 GILCO Hy-Gain Modified Tuner ..... \$15<sup>00</sup>
- #B21 GILCO Pre-drilled, Screen Printed, Circuit Board ..... \$17<sup>00</sup>
- #B22 GILCO Parts Kit (Less P/C Board) ..... \$80<sup>00</sup>
- #B20, B21, B22 Complete P/C Board and Parts Kit (all three) ..... \$110<sup>00</sup>
- #A02 Two stage, 28 db gain, Amplifier Kit ..... \$18<sup>50</sup>
- #A03 One stage, 14db gain, Amplifier Kit ..... \$10<sup>50</sup>

Name \_\_\_\_\_ Total \_\_\_\_\_  
Address \_\_\_\_\_ Tax \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_ Ship \_\_\_\_\_  
\_\_\_\_\_ Total \_\_\_\_\_

Mail Order Only. Send check or money order to:

**GILCO INTERNATIONAL, INC.**

P.O. Box 8817, Coral Gables, Florida 33124

CALL (305) 823-5891 for COD orders **PLEASE WRITE FOR OUR FREE CATALOG**  
Shipping Orders under \$50 add 10%, Orders over \$50 add 5%, FL residents +5% Tax

TECHNICIANS & SERVICEMEN

COMPONENTS FOR YOUR MAINTENANCE & REPAIR WORK

**SPECIAL: OUR LOW LOW PRICES**

REPLACEMENT FOR ECG® TYPES

TYPE NO.	YOUR COST	TYPE NO.	YOUR COST
85.....	FOUR for .99	125.....	SEVEN for .99
102A....	THREE for .99	159AP....	FOUR for .99
123A....	FIVE for .99	177.....	EIGHT for .99
123AP....	SIX for .99	199.....	FIVE for .99

### SUPER SPECIAL (MIN. 5 PC. EACH)

TYPE NO.	YOUR COST	TYPE NO.	YOUR COST	TYPE NO.	YOUR COST
124.....	.85	165.....	2.25	375.....	.90
128.....	.45	171.....	.65	506.....	.55
129.....	.45	184.....	.45	500A....	8.95
130.....	.80	185.....	.45	523.....	9.95
152.....	.40	238.....	2.25	526A....	10.20
153.....	.40	276.....	6.95	529.....	13.75
154.....	.60	291.....	.95	712.....	1.25

### JAPANESE TYPES (MIN. 5 PC. EACH)

2SC867A	2.75	HA1366W	1.85	STK0029	3.80
2SC1114	3.25	HA1377A	2.90	STK0080	9.99
2SC1308K	1.95	LA4102	1.25	TA7205AP	1.50
AN214Q	1.45	M51515BL	2.95	TA7208P	1.85
AN239A	4.60	STK433	3.95	TA7222AP	1.95
BA532...	1.80	STK435	3.95	UPC1181H	1.25
GH3F...	.89	STK437	6.25	UPC1182H	1.25
HA1342A	2.30	STK439	6.50	UPC1185H	2.99

COD ORDERS WELCOME (\$25 MIN. ORDER)

For Complete Component Catalog Call or Write

**DIGITRON ELECTRONIC**

110 HILLSIDE AVENUE, SPRINGFIELD, N.J. 07081

Toll Free: 800-526-4928 In NJ: 201-379-9016

\*ECG IS A TRADE MARK OF PHILIPS ECG.

DIGITRON ELECTRONIC IS NOT ASSOCIATED IN ANY WAY WITH PHILIPS ECG.

CIRCLE 11 ON FREE INFORMATION CARD

## More BLOCKBUSTER BARGAINS!!

### Parallel, TTL Input I/O "Selectric"® TYPEWRITER / PRINTER

Removed from working systems, these fantastic machines have built-in driver and decoder circuitry and take TTL level, 6-bit character, plus 4-bit function input signals. Easily driven by most any micro. Use a typewriter (with add'l 'repeat' circuitry) or as a KSR I/O printer or both. Requires 115.60Hz for typewriter motor, 5 VDC for TTL and 24 VDC for solenoids. "Table Top" style case. Each "Selectric"® I/O machine is complete and in operational condition. Includes schematics, data case, platen and ribbon.



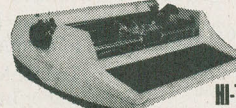
TESTED AND OPERATIONAL!

I/O Selectric ..... \$329.<sup>00</sup> ea.

Type Element ..... \$21.00ea. Add \$20 for Packaging and Handling - Pay shipping on Delivery

SAVE!!! Untested version of the above, otherwise whole & complete. May require some service ..... \$279.00 ea.

### Diablo Daisy Printer



HI-TYPE II

1355-WP Word Processing Daisy Printer

- Pre-owned, TESTED & Operational!
- Uses Xerox Metal Wheels or Plastic Wheels
- Original OEM Interface (Diablo Interface)
- Requires ±15V @5A & 5VDC @5A
- Positional access to 1/120 "Horiz." 1/48 "Vertical"
- USED BY XEROX, WANG, & OTHERS
- Heavy Duty Printwheel Motor and 15" Frame

These fabulous daisy printers feature 35-40cps, 10 & 12 pitch as well as proportional space, and plotter capabilities. Only a power supply and interface are required for full printer capability. Fully tested and operational, ready to configure for the interface of your choice. Platen and I/O data included

Forms tractor for the above ..... \$ 99.00

Spare P.C. Board Set (6 P.C. Cards) ..... \$279.00

Spare Printwheel carrier assembly ..... \$329.00

Serial & Parallel Interface for Above ..... \$295.00

Power Supply ..... \$ 79.00

**Just \$549.<sup>00</sup>**

Add \$15.00 for Packaging and handling

We Offer New & Used FLOPPY DRIVES, DISK DRIVES, PRINTERS, & MORE at BARGAIN PRICES!!!

Write or Call for Our Latest Flyer NOW!!!

"Selectric" is a registered trademark of IBM Corporation

**Computer Products & Peripherals Unlimited**

WAREHOUSE: 18 Granite St., Haverhill, Mass. 01830  
MAIL ORDERS: Box 204, Newton, New Hampshire 03858



**617/372-8637**

Sorry No Collect Calls  
MasterCard & VISA Accepted




CIRCLE 68 ON FREE INFORMATION CARD



# WE HAVE QUALITY PARTS, DISCOUNT PRICES AND FAST SHIPPING!

## TRANSFORMERS


**120 volt primaries**



5.6 VOLTS at 750 MA	\$3.00
6 VOLTS at 150 MA	\$1.25
16.5 V. at 3 AMPS	\$6.50
18 V at 650 MA	\$3.50
18 VOLTS at 1 AMP	\$4.50
18 V.C.T. at 2 AMP	\$5.50
24 VOLTS at 250 MA	\$2.50
24 VCT at 1 AMP	\$4.50
42 V.C.T. at 1.2 AMP	\$4.50

## DC WALL TRANSFORMER


**ALL ARE 115 VAC PLUG IN**



4 VDC at 70 MA	\$2.50
9 VDC at 225 MA	\$3.00
16.5 VAC at 10 VA	\$3.50
17 VAC at 500 MA	\$4.00

## 2K 10 TURN


**MULTI-TURN POT**



SPECTROL  
#MOD 534-7161  
\$5.00 EACH

## SOLID STATE RELAY

**CONTROL:**  
3-32VDC  
**LOAD:** 10 AMP  
140 VAC



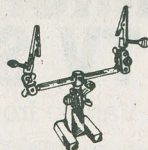
\$9.50 EACH

## 2 CHANNEL LIGHT ORGAN

EASILY HOOKS INTO STEREO SPEAKERS AND ALLOWS 110 VAC LIGHTS TO DANCE WITH MUSIC. TWO SEPARATE 110 VAC OUTPUTS FOR HIGH AND LOW FREQUENCY AUDIO SIGNALS. USE TWO ORGANS FOR STEREO...

\$6.50 PER UNIT

COLOR LIGHT STRING AVAILABLE \$1.75 EA




## HELPING HAND

WILL HOLD P.C. BOARD OR OTHER SMALL ITEMS AND ALLOW BOTH YOUR HANDS FREEDOM TO WORK.

\$6.50 EACH

## MULTI-SWITCHES

**3 STATION NON-INTERLOCKING**



3 - 2PDT SWITCHES. EACH OPERATES INDEPENDENTLY.  
1 1/4" BETWEEN MOUNTING CENTERS.  
\$1.75 EACH

**5 STATION INTERLOCKING**



MADE BY ALPS.  
3 - 2PDT AND 2 - 6PDT SWITCHES ON FULLY INTERLOCKING ASSEMBLY.  
3/4" BETWEEN MOUNTING CENTERS.  
\$2.50 EACH

**5 STATION NON-INTERLOCKING**


SAME AS ABOVE, EXCEPT EACH SWITCH OPERATES INDEPENDENTLY.  
\$2.50 EACH

## MIKE CONNECTOR

5 CONDUCTOR IN-LINE PLUG AND CHASSIS MOUNT JACK. TWIST LOCK STYLE, SAME AS SWITCHCRAFT 12CL5M.  
\$2.50 PER SET

## METER

**0 - 15 V.D.C.**



THIS 2-1/4" SQUARE METER MEASURES 0-15 VDC.  
\$4.50 EACH

## SUB-MINIATURE D TYPE CONNECTOR

SOLDER TYPE SUB-MINIATURE CONNECTORS USED FOR COMPUTER HOOK UPS.

DB-15 PLUG	\$2.75
DB-15 SOCKET	\$4.00
DB-15 HOOD	\$1.50
DB-25 PLUG	\$2.75
DB-25 SOCKET	\$3.50
DB-25 HOOD	\$1.25

## "PARALLEL" PRINTER CONNECTOR


SOLDER STYLE 36 PIN MALE USED ON "PARALLEL" DATA CABLES.  
\$5.50 EACH



## LIGHTS

### GRAIN OF WHEAT

**T1 SIZE**




.125" DIA. (3.15mm)

3 to 6 VOLTS	3 for \$1.00
Rated: 55ma @ 5 VOLTS	
6 to 12 VOLTS	3 for \$1.00
Rated: 55ma @ 8 VOLTS	
12 to 24 VOLTS	3 for \$1.00
Rated: 45ma @ 14 VOLTS	

### T1 SIZE

**WITH WIRE LEADS**



3 to 6 VOLTS	2 for \$1.00
Rated: 55ma @ 5 VOLTS	
6 to 12 VOLTS	2 for \$1.00
Rated: 55ma @ 8 VOLTS	
12 to 24 VOLTS	2 for \$1.00
Rated: 45ma @ 14 VOLTS	

### T1 - 3/4 SIZE WITH WIRE LEADS

.163" DIA. (4.14mm)

3 to 6 VOLTS	2 for \$1.00
Rated: 45ma @ 6 VOLTS	
6 to 12 VOLTS	2 for \$1.00
Rated: 55ma @ 8 VOLTS	
12 to 24 VOLTS	2 for \$1.00
Rated: 45ma @ 14 VOLTS	

### NEON W/ RESISTOR

DIRECT OPERATION  
7 for \$1.00 FROM 120 VOLT

### 120V INDICATOR

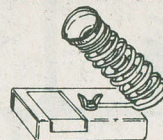
NEON INDICATOR. RATED 120 V 1/3 W. MOUNTS IN 5/16" HOLE. RED LENS.  
75¢ EACH  
10 FOR \$7.00  
100 FOR \$65.00



## SOLDERING IRON STAND

SPRING STEEL IRON HOLDER ON WEIGHTED BASE.

\$5.00 EACH



## 12 VOLT A.C. POWER UNIT

THIS UNIT CONSISTS OF A 12 VOLT 2 AMP TRANSFORMER, 1 AMP CIRCUIT BREAKER, 4 PRONG CINCH JONES SOCKET AND A 3 WIRE A.C. CORD ALL MOUNTED IN AN ATTRACTIVE 4 1/2" x 5 1/2" x 3" CHASSIS BOX. GOOD FOR PARTS OR A NICE START FOR D.C. POWER SUPPLY.

\$8.50 PER UNIT

## EDGE CONNECTORS

ALL ARE .156" SPACING

**15 PIN GOLD**  
SOLDER EYELET \$1.75 EACH

**15/30 GOLD**  
SOLDER EYELET \$2.00 EACH

**18/36 GOLD**  
SOLDER EYELET \$2.00 EACH

**22/44 TIN**  
P.C. STYLE, NO MOUNTING EARS.  
\$1.50 EACH 10 FOR \$14.00

**22/44 GOLD**  
P.C. STYLE \$2.00 EACH  
10 FOR \$18.00

**28/56 GOLD**  
28/56 GOLD PLATED CONTACTS .156 CONTACT SPACING.  
\$2.50 EACH 10 FOR \$22.00

**50/100 GOLD**  
STANDARD S-100 CONNECTOR. .125" SPACING. GOLD PLATED P.C. MOUNT.  
\$3.75 EACH 10 FOR \$35.00

## SWITCHES

### MINI-PUSH BUTTON


S.P.S.T. MOMENTARY NORMALLY OPEN 1/4" BUSHING  
35¢ EACH  
10 FOR \$3.25  
100 FOR \$30.00



SPECIFY COLOR: RED, BLACK, WHITE, GREEN, YELLOW.

### KEY SWITCH


S.P.S.T. 4 AMPS @ 125 VAC KEY REMOVES BOTH POSITIONS  
\$3.50 EA



### LIGHTED PUSH BUTTON

RED LIGHTED 120 VAC 10 AMP. S.P.S.T.

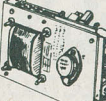
"POWER" PRINTED ON FACE. MOUNTS IN 7/8" SQUARE HOLE.  
\$1.50 EA 10 FOR \$13.50



FREE! FREE! FREE! SEND FOR NEW LARGER! 48 PAGE CATALOG FREE! FREE! FREE!

## POWER SUPPLY

REGULATED FULLY ADJUSTABLE 5 VDC AT 3 AMPS.




\$18.50 EACH

## KEY ASSEMBLY

**5 KEY** \$1.00 EACH  
CONTAINS 5 SINGLE-POLE NORMALLY OPEN SWITCHES. MEASURES 3 3/4" LONG

**6 KEY** \$1.25 EACH  
CONTAINS 6 SINGLE-POLE NORMALLY OPEN SWITCHES. MEASURES 4 1/4" LONG.



## TRANSISTORS

2N706	5 for \$1.00
2N2222A	4 for \$1.00
PN2222	8 for \$1.00
2N2904	4 for \$1.00
2N2905	4 for \$1.00
2N2907	4 for \$1.00

## LINE CORDS


**TWO WIRE**  
6' 18ga TWO WIRE 3 FOR \$1.00

**THREE WIRE**  
18 INCH 18ga THREE WIRE 2 for \$1.00

**8 FOOT 18ga THREE WIRE**  
\$2.00 EACH


## SOLID STATE RELAYS

**2 AMP**  
MOTOROLA #MP 120D2  
CONTROL - 3-6 VDC  
LOAD - 120VAC 2 AMPS  
T.T.L. COMPATIBLE.  
SIZE: 1 1/16" x 1/4" x 1" HIGH  
\$3.50 EACH 10 FOR \$32.00



## 10 AMP

TELEDYNE P/N 615-1  
CONTROL: 3-32 VDC  
LOAD: 10 AMP 140 VAC  
\$9.50 EACH




## ROTARY SWITCH

**1 POLE 6 POSITION**  
1 1/4" DIA x 1 1/2" HIGH  
75¢ EACH 10 FOR \$6.00



## RELAYS


**MINIATURE 6 VDC RELAY**



SUPER SMALL SPDT RELAY. GOLD COBALT CONTACTS.  
RATED 1 AMP AT 30 VDC. HIGHLY SENSITIVE. TTL DIRECT DRIVE POSSIBLE. OPERATES FROM 4.3 TO 6 V. COIL RES. 220 OHM.  
1 3/16" x 13/32" x 7/16"  
AROMAT # RSD-6V  
\$1.50 EACH 10 FOR \$13.50

## 13 VDC RELAY

CONTACT: S.P.N.C.  
10 AMP @ 120 VAC  
ENERGIZE COIL TO OPEN CONTACT.  
COIL: 13 VDC 650 OHMS  
SPECIAL PRICE \$1.00 EACH




## 4 PDT RELAY

14 pin style  
3 amp contacts  
24 volt d.c. or 120 volt a.c. coil  
Used but fully tested  
\$1.70 EACH  
specify coil voltage  
LARGE QUANTITIES AVAILABLE  
SOCKETS FOR RELAY 50¢ each



## COMPUTER GRADE CAPACITORS

1700 mfd. 150 VDC \$2.00  
2 1/2" DIA x 4 3/4" HIGH  
3,600 mfd. 40VDC \$1.00  
1 3/8" DIA x 3" HIGH  
6,400 mfd. 60 VDC \$2.50  
1 3/8" DIA x 4 1/4" HIGH  
22,000 mfd. 15 VDC 2" DIA. x 2 1/2" HIGH \$2.00  
22,000 mfd. 40 VDC 2" DIA. x 6" HIGH \$3.00  
24,000 mfd. 30 VDC 1 3/4" DIA. x 4" HIGH \$3.50  
31,000 mfd. 15 VDC 1 3/4" DIA. x 4" HIGH \$2.50  
72,000 mfd. 15 VDC 2" DIA. x 4" HIGH \$3.50  
180,000 mfd. at 6V 2 1/2" DIA. x 4 1/2" HIGH \$1.50  
CLAMPS TO FIT CAPACITORS 50¢ ea.



## MINIATURE TOGGLE SWITCHES

ALL ARE RATED 5 AMPS @ 125 VAC

<b>S.P.D.T. (on-on)</b> P.C. STYLE. NON-THREADED BUSHING. 75¢ EACH 10 FOR \$7.00	<b>S.P.D.T. (on-on)</b> SOLDER LUG TERMINALS. \$1.00 EACH 10 FOR \$9.00 100 FOR \$80.00	<b>S.P.D.T. (on-off-on)</b> SOLDER LUG TERMINALS. \$1.00 EACH 10 FOR \$9.00 100 FOR \$80.00
<b>S.P.D.T. (on-off-on)</b> NON-THREADED BUSHING. P.C. STYLE 75¢ EACH 10 FOR \$7.00	<b>S.P.D.T. (on-on)</b> P.C. LUGS. THREADED BUSHING. \$1.00 EACH 10 FOR \$9.00 100 FOR \$80.00	<b>D.P.D.T. (on-on)</b> SOLDER LUG TERMINALS. \$2.00 EACH 10 FOR \$19.00 100 FOR \$180.00

## SLIDE POTS

**100K linear tape**  
2" LONG  
1 5/8" TRAVEL 75¢ EACH

**500K linear taper**  
2 7/8" LONG  
1 3/4" TRAVEL 75¢ EACH

**DUAL 100K audio taper**  
3 1/2" LONG  
2 1/2" TRAVEL. \$1.50 EACH

## CRYSTALS

CASE STYLE HC33/U  
2 MHZ  
\$3.50 EACH  
COLORBURST 3579.545 KC \$1.00 EACH

## METAL OXIDE VARISTOR

G.E. # V82A12  
50 VOLTS, NOMINAL D.C. VOLTAGE. 5/8" DIAMETER.  
2 FOR \$1.50



## L.E.D.'S

**STANDARD JUMBO DIFFUSED**

RED	10 FOR \$1.50
GREEN	10 FOR \$2.00
YELLOW	10 FOR \$2.00

**FLASHER LED 5 VOLT OPERATION**  
RED JUMBO SIZE \$1.00 EACH

**BIPOLAR LED**  
2 FOR \$1.70


## SUB MINI LED

.079" x .098"

RED	10 FOR \$1.00
200 FOR \$18.00	
GREEN	10 FOR \$1.50

## LED HOLDERS

TWO PIECE HOLDER FOR JUMBO LED  
10 FOR 65¢ 200 FOR \$10.00



## PHOTO-FLASH CAPACITORS

**35 MFD 330 VOLT**

1" x 5/8" DIA.  
45¢ EACH...  
10 FOR \$4.00

**170 MFD 330 VOLT**

1 1/8" x 7/8"  
2 FOR \$1.50 10 FOR \$7.00

**750 MFD 330 VOLT**

2" HIGH x 1 1/4" DIA.  
\$1.25 EACH 10 FOR \$11.00



## POWER SUPPLY W/ PRE-AMP

THIS SUPPLY WAS USED TO POWER AN 8 TRACK/CASSETTE UNIT. IT WILL SUPPLY APPROX. 18 VDC AND INCLUDES A SMALL PRE-AMP TO BOOST SIGNAL LEVEL. RCA PLUGS FOR LINE IN/OUT.



\$4.50 EACH

TOLL FREE ORDERS ONLY  
1-800-826-5432  
(ORDER ONLY)  
(IN CALIFORNIA: 1-800-258-6666)  
ALASKA, HAWAII,  
OR INFORMATION  
(213) 380-8000

**ALL ELECTRONICS CORP.**  
**ALL ELECTRONICS CORP.**

905 S. Vermont Ave. P.O. BOX 20406 Los Angeles, Calif. 90006

CIRCLE 12 ON FREE INFORMATION CARD

QUANTITIES LIMITED  
MINIMUM ORDER \$10.00  
USA: \$2.50 SHIPPING  
FOREIGN ORDERS:  
INCLUDE SUFFICIENT  
SHIPPING  
CALIF. RES. ADD 6 1/2%  
NO C.O.D.!





**C 126 D**  
400 V  
12 AMP  
SCR  
TO-220 CASE  
99¢  
10/59

**X-1550 \$250 10/522**  
WT 0.2 LB

**SNOOPER AMPLIFIER**  
WOW!! AN INTERCOM, BUGGING DEVICE, & PA SYSTEM ALL ON A 3-1/2" X 1-1/4" PC BOARD! RUNS ON 9V, HAS 1-SN6923 AUDIO AMP IC, 8 A SPEAKER, PLUS AN ELECTRET MICROPHONE - 3/8" DIA X 1/2" LONG

**TTL CLEARANCE**  
7427 TRIPLE 3-NOR 12¢  
74LS37 QUAD 2-NAND 12¢  
74S15 DUAL AND/OR INVERT 12¢  
74S14 DUAL FF 15¢  
74LS86 QUAD EXCL-OR 10¢  
74LS93 4-BIT BINARY CTR 15¢  
7497 RATE MULTIPLIER 15¢  
74141 BCD-DECIMAL 15¢  
74LS151 1 OF 8 MULTIPLEXER 15¢  
74LS163 4-BIT BINARY CTR 12¢  
74LS164 8-BIT SHIFT REG 15¢  
75183 DUAL LINE INVR 15¢  
PRIME STOCK!

**LM384**  
5W AUDIO AMP  
P = 55W  
TND = 25%  
BW = 450KHz  
Av = 34 db  
Vcc = 28VDC MAX  
**STOCK UP NOW!**  
DATA SHEET 251

**39¢**

**SPACE GUN**  
SOUND EFFECTS  
X-1560  
10/1750  
WT 0.2 LB

THIS BABY PRODUCES STRANGER TUNES THAN A COCKTAIL IN HEAT!!  
RUNS ON 9V

**95¢**

**Ammonium Persulfate ETCHANT**  
FAST & EASY TO USE  
JUST ADD WATER & ETCH  
TURNS BLUE WHEN FULL OF COPPER 1 LB MAKES 2 GALLONS  
H-2240 10/1750

**95¢**

**HEADLIGHT SWITCH**  
MARINE  
QUALITY 3 POSITION (OFF-PARK-LIGHT) SWITCHES ARE GREAT FOR LOTS OF HEAVY DUTY APPLICATIONS. THESE SELL FOR \$9.95 AT YOUR AUTO PARTS STORE

**39¢**

**POWER SUPPLY**  
12-15 VOLT 1.6 AMP  
COMMERCIAL POWER SUPPLY  
STANDARD POWER TYPES SPS-30-15, BRAND NEW, INDIVIDUALLY BOXED, 115V/250V INPUT  
VOLTAGE REGULATED, CURRENT LIMIT

**SUPER SPECIAL \$15**  
X-3015 3 LB

**8/16 TRACK TAPE HEADS**  
INSTRUMENTATION MFR PAID OVER 1,000 PER HEAD WITH A RESPONSE > 50,000Hz AT 7-1/2 IPS, THESE HONEYEYS PERFORM! 8 TRKS ON 1" TAPE, 2 HEADS CAN BE STAGGERED TO GET 16 TRKS. NEW, UNUSED.

**R-8 8 TRK RECORD OR P-8 8 TRK PLAY \$35 ea.**

THIS BATCH IS NEW, REMOVED FROM EQUIP. PP-8 1" PLAY 8 TRK (A LIL' BIN RASH, NOTHING SERIOUS)  
PP-14 1" PLAY 14 TRK  
PP-28 2" PLAY 28 TRK

**\$15**

**BUBBLE MEMORY ASSEMBLIES**  
FOR LSI-11 COMPUTERS \* FLOPPY DISK REPLACEMENTS \*  
THESE BRAND NEW, SURPLUS UNITS ARE BEING OFFERED AT GIVE-AWAY PRICES! A "BUBBLE MACHINE" CONSISTS OF 1-2-80 CONTROLLER CARD AND 1-16 BUBBLE MEMORY BOARDS. THE BOARDS CAN BE PLUGGED DIRECTLY INTO THE LSI-11 BUS, OR THE EXTERNAL CARD CAGE (SEE BELOW) USING ONLY POWER & GROUND LINES. THE CONTROLLER RESPONDS TO RXVIR/XXOI FLOPPY DISK PROTOCOL. EACH MEMORY BOARD CONTAINS 40,960 BYTES OF NON-VOLATILE DATA. THEY ARE REMOVABLE WITHOUT LOSS OF DATA! THESE BOARDS CAN BE INSTALLED & USED WITHOUT MODIFICATION TO THE DEC OPERATING SYSTEM. BMA-1 IS ALL YOU NEED TO GET GOING -- REMEMBER, THESE ARE SURPLUS AND WILL VANISH QUICKLY! ORDER EXTRA MEMORY BOARDS NOW! \* NOTE: DEC, LSI-11, & RT-11 ARE REGISTERED TRADEMARKS OF DIGITAL EQUIPMENT CORP.

BMA-1 STARTER KIT 1-CONTROLLER BOARD 1-BUBBLE MEMORY BOARD 1-MANUAL  
**\$250.00**

BMA-2 EXTRA BUBBLE MEMORY BOARD \$150.00

BMA-3 EXPANSION CARD CAGE 16 SLOT \$65.00

BMA-4 MANUAL WITH SCHEMATICS \$15.00

WT 8 LB

**EPROMS**  
PRIME  
1" QUALITY  
450 NS  
2732 \$4.50  
2764 \$7.95

**DB 9P**  
GOLD PINS  
MFD BY CANNON  
POPULAR PLUS FOR JOY-STICKS, EXPANSION AND COMMUNICATION PORTS. THESE ARE TOP QUALITY CANNON UNITS.  
B-2139  
WT 0.1 LB  
**99¢**

**CABLE TV**  
X-1085  
10¢/4.35  
WT 3 LB

**Midband Converter**  
BRAND NEW PRODUCTION AEL UNIT TAKES THE "HIDDEN CHANNELS" ON MIDBAND AND MOVES THEM TO CHANNELS 7-13. SWITCH SELECTS "NORMAL" OR "MIDBAND". JUST PUT IN LINE WITH YOUR CABLE AND SWITCH BACK & FORTH. 115 VAC WITH OUTLET FOR YOUR TV. ONLY TWO CONNECTIONS IN & OUT. OVERALL SIZE IS 6 X 4-5/8 X 2-1/2 HIGH

**ELECTRONIC BARGAINS**  
IF YOU'RE NOT ON OUR MAILING LIST, YOU'RE MISSING OUT! STANDING BUYS ON THE FINEST IN ELECTRONIC PARTS FOR THE BUILDER. IN 8 YEARS OVER 250,000 HOBBYISTS HAVE DISCOVERED WHERE TO FIND USEFUL, UNIQUE OR DOWNRIGHT STRANGE ELECTRONICS AT GIVEAWAY PRICES. WHY NOT SEND FOR OUR CATALOG TODAY --- IT'S FREE!!

**DIAMONDBACK**  
ELECTRONICS COMPANY  
PO BOX 12095 Dept 102  
SARASOTA, FLA. 33578

Phone Orders (813) 953-2829

CONTINENTAL US ADD \$1.60 FOR THE FIRST LB AND 50¢ FOR EACH ADDITIONAL LB.  
WEST COAST ADD \$1.80 FOR THE FIRST POUND & 50¢ FOR EACH ADDITIONAL POUND.  
GOD & MAIL ORDER \$7 MINIMUM. CREDIT CARDS \$15 MIN.

CIRCLE 95 ON FREE INFORMATION CARD

HIGH QUALITY UP TO 55dB GAIN

# MICROWAVE TV SYSTEM

Varible from 1.9 to 2.5 GHz



The latest advance in microwave technology with a SNOW-FREE PICTURE.

Two Models to choose from.

Both Models Include:

- 20" Parabolic Dish
- Pre-assembled Probe with Parabolic Converter
- Power Supply and Coax Switch
- 60' of RG-59/U Coax with Connector
- Transformer for 75 to 300 Ohms
- All Mounting Hardware for Fast and Easy Installation

**20" Fiberglass Dish**  
Up to 55dB Gain  
Special **\$98.95\***

**20" Aluminum Dish**  
Up to 40dB Gain  
Low Priced **\$74.95\***

\*Includes Shipping and Handling

Available thru Mail and Phone Orders Only  
Send Cashiers Check or Money Order to:  
(Personal Checks, allow 2-5 weeks to clear)

**PROFESSIONAL VIDEO, Inc.**  
4670 Hollywood Blvd., Hollywood, Calif. 90027  
For C.O.D. Orders Call (213) **219-0227**  
**352-9681**

CIRCLE 30 ON FREE INFORMATION CARD

**TUSA**  
A WHOLE NEW WORLD OF TV VIEWING WITH TUSA'S NEW MODEL CVU-40, 40 CHANNEL CABLE TV CONVERTER. Receive all the EXTRA CABLE TV "MIDBAND" & "SUPERBAND" CHANNELS on your UHF DIAL. Eliminates the need for renting or leasing. This system takes the "midband" and "superband" channels your TV, VCR or projector can't receive and converts them to standard UHF channels that any set can tune in.

**A MUST FOR VIDEO-TAPING FROM CABLE TV!**  
The system allows you to program both pay (pay TV decoder required) and standard cable channels for taping on any VCR -- while you are watching a different channel on your TV. Simple to install and operate on any make of TV with UHF.

**NOW AVAILABLE**  
**NEW TUNABLE DELUXE MODEL CVU-1000 \$34.95 ea.**

**WINEGARD**  
75 OHM UHF YAGI ANTENNAS

12 db GAIN  
Specify Channel  
Preamp  
18db Gain  
NF - 1.8db  
\$8.95 ea.  
8 OR MORE \$6.95 ea.  
\$39.95 ea.

**Now Back In Stock!**  
**SANYO UHF VARIATOR TUNERS**  
75 Ohm Input - 45 MHz Output  
For Channels 14 - 83

MODEL 115B-403A  
**\$19.95 EACH**

All units are brand new from Sanyo  
Call for Quantity Price

**SPEAKER CABINET**  
Popular speaker cabinets for those famous homebrew TV circuits.  
Speakers included.  
Dimensions: 7 1/4" wide x 9 1/4" high x 5 1/2" deep. Removable 1/8" thick back cover.  
SC001 \$10.95 ea.  
2 or more \$8.95 ea.

**QUALITY POWER TRANSFORMERS**  
24V CT, 400 mA.  
\$3.19 ea. 10 - 45 \$2.75 ea.  
50 or more \$2.25 ea.

**NEW 1984 B&K AUTO/MANUAL RANGING MULTIMETER**  
MODEL 2807  
**SPECIAL PRICE! \$94.00 ea.**  
**BK PRECISION**

**SONY SURPLUS UHF-VHF VARIATOR TUNERS**  
These tuners receive all channels 2-83, plus midband cable channels and are perfect for home-brew TV circuits etc. Output Freq. 45 MHz. Hookup data included. Name Brand.

#852  
**NOW! \$15.95 ea.**

**UHF TUNERS**  
45 MHz Output

Click Stop Detent Tune meter. Excellent for replacement use or experimental work building UHF receivers for ham or TV.

**WHILE THEY LAST**  
\$3.95 ea.  
10 or more \$3.25 ea.

**AC LINE CORDS**  
18 gauge wire  
6 ft. long cable  
Prestripped and tinned ends for easy installation.  
49¢ ea.  
AC-60 12-Up \$39.95 ea.

**POPULAR IC's**  
TOP QUALITY NO SECONDS

TYPE	DESCRIPTION	1-9	10-UP
LM-3800	2 watt Audio Power Amp	\$1.49	\$ .89
LM-3803	Low Voltage Audio Amp	1.59	1.19
LM-555N	Phase Locked Loop	1.49	.99
LM-733N	Video Amp	1.69	.98
MC-1330	Video Detector	2.29	.99
MC-1349	Video II Amp	2.06	1.55
MC-1350	Video II Amp	1.75	1.19
MC-1352	Video II Amp AGC	2.69	2.09
MC-1356	Audio II Amp	1.95	1.54
MC-1374P	R.F. Modulator	3.19	2.39
MC-1458	Dual Comp. Op Amp	.88	.59
MC-1496N	Balanced Mod/Demodulator	1.79	1.34
LM-1889	Video Monitor	2.79	1.95
LM-7805	5 Volt Positive Volt. Reg.	1.19	.89
LM-7808	8 Volt Positive Volt. Reg.	1.19	.89
LM-7812	12 Volt Positive Volt. Reg.	1.19	.89
LM-7815	15 Volt Positive Volt. Reg.	1.19	.89
LM-7818	18 Volt Positive Volt. Reg.	1.19	.89
LM-7824	24 Volt Positive Volt. Reg.	1.19	.89

NE-564 New Plug-In Replacement now in stock - \$5.75 ea. or \$3.50 each with any \$50.00 purchase of other parts.

**UNITECH MODEL DUP1T TELEPHONE**  
This handsome contemporary telephone is Touch-tone, making it ideal for MCI or Sprint service, or banking by phone. Deluxe two piece design allows for wall or desk mount. Also on-off finger switch. Almond in color.  
**NOW \$29.95 ea.**

**PROJECT BOXES**  
Woodgrain

This box is 11 1/4" W - 4 1/4" H - 8 1/4" D with a removable aluminum U-shaped chassis. 11" W - 3 1/4" H - 6" D inside.  
**\$12.50**  
4 or more **\$10.95 ea.**  
For Larger Quantities - CALL

**75 OHM CHASSIS MOUNT CONNECTOR**  
F-61 Female connector. Rear chassis mount with nut. Mates with male "F" connectors.  
**NOW! 4 for \$1.00**

**Now Back In Stock!**  
**DELUXE A-B SWITCHES**  
Specify Pushbutton or lever type  
For CATV - MATV - VCR  
75 ohm - 90 db Isolation  
**\$6.95 ea.**  
2 or more **\$5.95 ea.**

**ORDER NOW TOLL FREE**  
800-854-4655  
OUTSIDE CALIFORNIA  
714-635-5090  
INSIDE CALIFORNIA

**R.F. ELECTRONICS**  
1056 N. STATE COLLEGE BLVD., DEPT. R  
ANAHEIM, CALIFORNIA 92806

PERSONAL CHECKS HELD FOR CLEARANCE - NO MINIMUM ORDER  
ALL PREPAID ORDERS 2 LBS OR LESS MUST INCLUDE \$2.50 SHIPPING & HANDLING - SHIPPED SAME DAY RECEIVED

OPEN TUES - FRI 10-6  
SAT 10-5  
CLOSED SUN & MON

SEND FOR FREE Mail Order Catalog

CIRCLE 27 ON FREE INFORMATION CARD

# TEK-EL

TECHNICAL ELECTRONICS  
YOUR SUPPLY SOURCE WITH ASSORTMENTS LIKE THESE:

**LED ASSORTMENT** 25 LEDs at a price everyone can afford! Red, Green, Yellow, Amber in all shapes and sizes.

Stock No. 10-1501 **\$2.95 pkg.**

**SWITCH ASSORTMENT** 8 general purpose toggle switches. Includes single, double, and three pole switches from top manufacturers such as Cutler-Hammer and others!

Stock No. 12-2230 **\$6.95 pkg.**

**FOOT ASSORTMENT** Plastic, rubber, snap-fit, felt bottom, stud mount, you name it—it's in this assortment of approx. 100 feet.

Stock No. 49-2398 **\$2.95 pkg.**

**SLIDE SWITCH ASSORTMENT** Includes SPDT and DPDT slides. 10 pieces per package.

Stock No. 12-1400 **\$1.50 pkg.**

**ODDS-N-ENDS BARGAIN BOX** 5 pound Random assortment of good quality components and parts. Includes items such as capacitors, diodes, motors, transformers, printed circuit boards, and much much more!

Stock No. 49-3041 **\$10.00 pkg.**

**TERMINAL STRIP ASSORTMENT** Half pound of approx. 100 pieces. Random assortment of sizes and lengths.

Stock No. 49-2400 **\$2.95 pkg.**

ORDER TODAY! VISA, MASTERCARD & COD accepted for phone orders. Please add \$3.00 for UPS ground. Satisfaction guaranteed. Call or write for your **FREE CATALOG!**

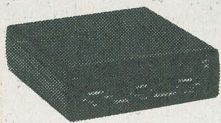
**TECHNICAL ELECTRONICS**  
Dept. M P.O. Box 2361  
Woburn, MA 01888 (617) 935-1717

CIRCLE 8 ON FREE INFORMATION CARD



ramsey

the first name in Counters!



9 DIGITS 600 MHz \$129<sup>95</sup> WIRED

**PRICES:**

CT-90 wired, 1 year warranty	\$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than \$300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10MHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally, an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

**SPECIFICATIONS:**

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 MHz, 1.0 ppm 20-40°C Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz \$99<sup>95</sup> WIRED



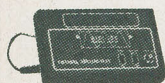
**SPECIFICATIONS:**

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

**PRICES:**

CT-70 wired, 1 year warranty	\$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95



7 DIGITS 500 MHz \$79<sup>95</sup> WIRED

**PRICES:**

MINI-100 wired, 1 year warranty	\$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

**SPECIFICATIONS:**

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz \$159<sup>95</sup> WIRED



**SPECIFICATIONS:**

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

**PRICES:**

CT-50 wired, 1 year warranty	\$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

NEW  
READ  
FREQUENCY



DIGITAL MULTIMETER \$99<sup>95</sup> WIRED

**PRICES:**

DM-700 wired, 1 year warranty	\$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack + AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3 1/2 digit, 1/2 inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

**SPECIFICATIONS:**

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current:	0.1uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	0.1% basic DC volts
Power:	4 'C' cells

**AUDIO SCALER**

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

\$29.95 Kit \$39.95 Wired

**ACCESSORIES**

Telescopic whip antenna - BNC plug	\$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

**COUNTER PREAMP**

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

\$34.95 Kit \$44.95 Wired

ramsey electronics, inc.

2575 BAIRD RD. • PENFIELD, NY 14526



PHONE ORDERS  
CALL 716-586-3950

**TERMS**

Satisfaction guaranteed - examine for 10 days, if not pleased return in original form for refund. Add 5% for shipping insurance to a maximum of \$10. Overseas add 15% COD add \$2. Orders under \$10, add \$1.50. NY residents, add 7% tax.

CIRCLE 79 ON FREE INFORMATION CARD

DECEMBER 1983







# CORPORATION

**NATIONAL SEMICONDUCTOR • PANASONIC**  
**DAVID • CHEMIVK • ATLANTIC DIODES • F. J.**  
**DAVID • CHEMIVK • ATLANTIC DIODES • F. J.**  
**DAVID • CHEMIVK • ATLANTIC DIODES • F. J.**

**SAVINGS - Volume Discounts • OEM Quantity Pricing • Toll Free 800 Number**

**QUALITY - Name brand products from nationally recognized manufacturers.**

**SERVICE - Computerized order processing and inventory control.**

**THE Big DIGIKEY Discount makes a Big Price Difference**

**in Mn., Ak., Hi. Call 218-681-6674**

**3 AMP SILICON RECTIFIER**



**Typical Applications Include:**  
 Clock Radio, Timer, Alarm Clock, Desk Clock, TV and Stereo, Instrument Panel Clock, Digital Timer, and more.

**MA1026 7 Inch 4-Digit LED Display**

**Glant 7 Time 4-Digit LED Display**

**• P and/or C and virtually any number of sensors.**

**• 50/60 Hz frequency operation**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

**• 12 or 24 hour display**

## Silicon Transistors

**Part No. Price**

**2N3638 1.44 100 100 1000**

**2N3639 2.20 20 180 172.25**

**2N3640 2.20 20 180 172.25**

**2N4124 2.20 20 180 172.25**

**2N4400 2.20 20 180 172.25**

**2N4401 2.20 20 180 172.25**

**2N4402 2.20 20 180 172.25**

**2N4403 2.20 20 180 172.25**

**2N4404 2.20 20 180 172.25**

**2N4405 2.20 20 180 172.25**

**2N4406 2.20 20 180 172.25**

**2N4407 2.20 20 180 172.25**

**2N4408 2.20 20 180 172.25**

**2N4409 2.20 20 180 172.25**

**2N4410 2.20 20 180 172.25**

**2N4411 2.20 20 180 172.25**

**2N4412 2.20 20 180 172.25**

**2N4413 2.20 20 180 172.25**

**2N4414 2.20 20 180 172.25**

**2N4415 2.20 20 180 172.25**

**2N4416 2.20 20 180 172.25**

**2N4417 2.20 20 180 172.25**

**2N4418 2.20 20 180 172.25**

**2N4419 2.20 20 180 172.25**

**2N4420 2.20 20 180 172.25**

**2N4421 2.20 20 180 172.25**

**2N4422 2.20 20 180 172.25**

**2N4423 2.20 20 180 172.25**

**2N4424 2.20 20 180 172.25**

**2N4425 2.20 20 180 172.25**

**2N4426 2.20 20 180 172.25**

**2N4427 2.20 20 180 172.25**

**2N4428 2.20 20 180 172.25**

**2N4429 2.20 20 180 172.25**

**2N4430 2.20 20 180 172.25**

**2N4431 2.20 20 180 172.25**

**2N4432 2.20 20 180 172.25**

**2N4433 2.20 20 180 172.25**

**2N4434 2.20 20 180 172.25**

**2N4435 2.20 20 180 172.25**

**2N4436 2.20 20 180 172.25**

**2N4437 2.20 20 180 172.25**

**2N4438 2.20 20 180 172.25**

**2N4439 2.20 20 180 172.25**

**2N4440 2.20 20 180 172.25**

**2N4441 2.20 20 180 172.25**

**2N4442 2.20 20 180 172.25**

**2N4443 2.20 20 180 172.25**

**2N4444 2.20 20 180 172.25**

**2N4445 2.20 20 180 172.25**

**2N4446 2.20 20 180 172.25**

**2N4447 2.20 20 180 172.25**

**2N4448 2.20 20 180 172.25**

**2N4449 2.20 20 180 172.25**

**2N4450 2.20 20 180 172.25**

**2N4451 2.20 20 180 172.25**

**2N4452 2.20 20 180 172.25**

**2N4453 2.20 20 180 172.25**

**2N4454 2.20 20 180 172.25**

**2N4455 2.20 20 180 172.25**

**2N4456 2.20 20 180 172.25**

**2N4457 2.20 20 180 172.25**

**2N4458 2.20 20 180 172.25**

**2N4459 2.20 20 180 172.25**

**2N4460 2.20 20 180 172.25**

**2N4461 2.20 20 180 172.25**

**2N4462 2.20 20 180 172.25**

**2N4463 2.20 20 180 172.25**

**2N4464 2.20 20 180 172.25**

**2N4465 2.20 20 180 172.25**

**2N4466 2.20 20 180 172.25**

**2N4467 2.20 20 180 172.25**

**2N4468 2.20 20 180 172.25**

**2N4469 2.20 20 180 172.25**

**2N4470 2.20 20 180 172.25**

**2N4471 2.20 20 180 172.25**

**2N4472 2.20 20 180 172.25**

**2N4473 2.20 20 180 172.25**

**2N4474 2.20 20 180 172.25**

**2N4475 2.20 20 180 172.25**

**2N4476 2.20 20 180 172.25**

**2N4477 2.20 20 180 172.25**

**2N4478 2.20 20 180 172.25**

**2N4479 2.20 20 180 172.25**

## Termination Jumpers

**Part No. Price**

**2N3638 1.44 100 100 1000**

**2N3639 2.20 20 180 172.25**

**2N3640 2.20 20 180 172.25**

**2N4124 2.20 20 180 172.25**

**2N4400 2.20 20 180 172.25**

**2N4401 2.20 20 180 172.25**

**2N4402 2.20 20 180 172.25**

**2N4403 2.20 20 180 172.25**

**2N4404 2.20 20 180 172.25**

**2N4405 2.20 20 180 172.25**

**2N4406 2.20 20 180 172.25**

**2N4407 2.20 20 180 172.25**

**2N4408 2.20 20 180 172.25**

**2N4409 2.20 20 180 172.25**

**2N4410 2.20 20 180 172.25**

**2N4411 2.20 20 180 172.25**

**2N4412 2.20 20 180 172.25**

**2N4413 2.20 20 180 172.25**

**2N4414 2.20 20 180 172.25**

**2N4415 2.20 20 180 172.25**

**2N4416 2.20 20 180 172.25**

**2N4417 2.20 20 180 172.25**

**2N4418 2.20 20 180 172.25**

**2N4419 2.20 20 180 172.25**

**2N4420 2.20 20 180 172.25**

**2N4421 2.20 20 180 172.25**

**2N4422 2.20 20 180 172.25**

**2N4423 2.20 20 180 172.25**

**2N4424 2.20 20 180 172.25**

**2N4425 2.20 20 180 172.25**

**2N4426 2.20 20 180 172.25**

**2N4427 2**





COMPUTER  
PRODUCTS,  
Inc.

ORDER TOLL FREE

(800)  
538-8800

(CALIFORNIA RESIDENTS)

(800)  
848-8008



**TERMS:** For shipping include \$2.00 for UPS Ground or \$3.00 for UPS Blue Air. \$10.00 minimum order. Bay Area and Los Angeles Counties add 6½% Sales Tax, other California residents add 6% Sales Tax. We reserve the right to limit quantities and substitute manufacturer. Prices subject to change without notice.

VISIT OUR RETAIL STORE

2100 De La Cruz Blvd.  
Santa Clara, CA 95050  
(408) 988-0697



## STATIC RAMS

2101	256 x 4 (450ns)	1.90
5101	256 x 4 (450ns) (cmos)	3.90
2102-1	1024 x 1 (450ns)	.88
2102L-4	1024 x 1 (450ns) (LP)	.98
2102L-2	1024 x 1 (250ns) (LP)	1.45
2111	256 x 4 (450ns)	2.45
2112	256 x 4 (450ns)	2.95
2114	1024 x 4 (450ns)	8/9.90
2114-25	1024 x 4 (250ns)	8/9.95
2114L-4	1024 x 4 (450ns) (LP)	8/11.95
2114L-3	1024 x 4 (300ns) (LP)	8/12.45
2114L-2	1024 x 4 (200ns) (LP)	8/12.95
2147	4096 x 1 (55ns)	4.90
TMS4044-4	4096 x 1 (450ns)	3.45
TMS4044-3	4096 x 1 (300ns)	3.95
TMS4044-2	4096 x 1 (200ns)	4.45
MK4118	1024 x 8 (250ns)	9.90
TMM2016-200	2048 x 8 (200ns)	4.10
TMM2016-150	2048 x 8 (150ns)	4.10
TMM2016-100	2048 x 8 (100ns)	6.10
HM6116-4	2048 x 8 (200ns) (cmos)	4.70
HM6116-3	2048 x 8 (150ns) (cmos)	4.90
HM6116-2	2048 x 8 (120ns) (cmos)	8.90
HM6116LP-4	2048 x 8 (200ns) (cmos)(LP)	5.90
HM6116LP-3	2048 x 8 (150ns) (cmos)(LP)	6.90
HM6116LP-2	2048 x 8 (120ns) (cmos)(LP)	9.95
Z-6132	4096 x 8 (300ns) (Qstat)	33.95

LP = Low Power Qstat = Quasi-Static

## DYNAMIC RAMS

TMS4027	4096 x 1 (250ns)	1.95
UPD411	4096 x 1 (300ns)	2.95
MM5280	4096 x 1 (300ns)	2.95
MK4108	8192 x 1 (200ns)	1.90
MM5298	8192 x 1 (250ns)	1.80
4116-300	16384 x 1 (300ns)	8/10.75
4116-250	16384 x 1 (250ns)	8/10.95
4116-200	16384 x 1 (200ns)	8/11.95
4116-150	16384 x 1 (150ns)	8/13.95
4116-120	16384 x 1 (120ns)	8/28.95
2118	16384 x 1 (150ns) (5v)	4.90
4164-200	65536 x 1 (200ns) (5v)	5.90
4164-150	65536 x 1 (150ns) (5v)	6.90

5V = single 5 volt supply

## EPROMS

1702	256 x 8 (1us)	4.45
2708	1024 x 8 (450ns)	3.90
2758	1024 x 8 (450ns) (5v)	5.90
2716	2048 x 8 (450ns) (5v)	3.90
2716-1	2048 x 8 (350ns) (5v)	5.90
TMS2516	2048 x 8 (450ns) (5v)	5.45
TMS2716	2048 x 8 (450ns)	7.90
TMS2532	4096 x 8 (450ns) (5v)	5.90
2732	4096 x 8 (450ns) (5v)	4.90
2732-250	4096 x 8 (250ns) (5v)	8.90
2732-200	4096 x 8 (200ns) (5v)	10.95
2764	8192 x 8 (450ns) (5v)	9.90
2764-250	8192 x 8 (250ns) (5v)	13.95
2764-200	8192 x 8 (200ns) (5v)	23.95
TMS2564	8192 x 8 (450ns) (5v)	16.95
MC68764	8192 x 8 (450ns) (5v)(24 pin)	38.95
27128	16384 x 8Call	Call

5v = Single 5 Volt Supply

## 74LS00

74LS00	.23	74LS173	.68
74LS01	.24	74LS174	.54
74LS02	.24	74LS175	.54
74LS03	.24	74LS181	2.10
74LS04	.23	74LS189	8.90
74LS05	.24	74LS190	.88
74LS08	.27	74LS191	.88
74LS09	.28	74LS192	.78
74LS10	.24	74LS193	.78
74LS11	.34	74LS194	.68
74LS12	.34	74LS195	.68
74LS13	.44	74LS196	.78
74LS14	.58	74LS197	.78
74LS15	.34	74LS221	.88
74LS20	.24	74LS240	.94
74LS21	.28	74LS241	.98
74LS22	.24	74LS242	.98
74LS26	.28	74LS243	.98
74LS27	.28	74LS244	1.25
74LS28	.34	74LS245	1.45
74LS30	.24	74LS247	.74
74LS32	.28	74LS248	.98
74LS33	.54	74LS249	.98
74LS37	.34	74LS251	.58
74LS38	.34	74LS253	.58
74LS40	.24	74LS257	.58
74LS42	.48	74LS258	.58
74LS47	.74	74LS259	2.70
74LS48	.74	74LS260	.58
74LS49	.74	74LS266	.54
74LS51	.24	74LS273	1.45
74LS54	.28	74LS275	3.30
74LS55	.28	74LS279	.48
74LS63	1.20	74LS280	1.95
74LS73	.38	74LS283	.68
74LS74	.34	74LS290	.88
74LS75	.38	74LS293	.88
74LS76	.38	74LS295	.98
74LS78	.48	74LS298	.88
74LS83	.59	74LS299	1.70
74LS85	.68	74LS323	3.45
74LS86	.38	74LS324	1.70
74LS90	.54	74LS352	1.25
74LS91	.88	74LS353	1.25

74LS92	.54	74LS363	1.30
74LS93	.54	74LS364	1.90
74LS95	.74	74LS365	.48
74LS96	.88	74LS366	.48
74LS107	.38	74LS367	.44
74LS109	.38	74LS368	.44
74LS112	.38	74LS373	1.35
74LS113	.38	74LS374	1.35
74LS114	.38	74LS377	1.35
74LS122	.44	74LS378	1.13
74LS123	.78	74LS379	1.30
74LS124	2.85	74LS385	1.85
74LS125	.48	74LS386	.44
74LS126	.48	74LS390	1.15
74LS132	.58	74LS393	1.15
74LS133	.58	74LS395	1.15
74LS136	.38	74LS399	1.45
74LS137	.98	74LS424	2.90
74LS138	.54	74LS447	.36
74LS139	.54	74LS490	1.90
74LS145	1.15	74LS624	3.95
74LS147	2.45	74LS640	2.15
74LS148	1.30	74LS645	2.15
74LS151	.54	74LS668	1.65
74LS153	.54	74LS669	1.85
74LS154	1.85	74LS670	1.45
74LS155	.68	74LS674	9.60
74LS156	.68	74LS682	3.15
74LS157	.64	74LS683	3.15
74LS158	.58	74LS684	3.15
74LS160	.68	74LS685	3.15
74LS161	.64	74LS688	2.35
74LS162	.68	74LS689	3.15
74LS163	.64	74LS783	23.95
74LS164	.68	81LS95	1.45
74LS165	.94	81LS96	1.45
74LS166	1.90	81LS97	1.45
74LS168	1.70	81LS98	1.45
74LS169	1.70	25LS2521	2.75
74LS170	1.45	25LS2569	4.20

## 6500 1MHZ

6502	4.90
6504	6.90
6505	8.90
6507	9.90
6520	4.30
6522	7.90
6532	9.90
6545	21.50
6551	10.85

## 2 MHZ

6502A	6.90
6522A	9.90
6532A	10.95
6545A	26.95
6551A	10.95

## 3 MHZ

6502B	13.95
-------	-------

## 6800

68000	58.95
6800	3.90
6802	7.90
6808	12.90
6809E	18.95
6809	10.95
6810	2.90
6820	4.30
6821	3.20
6828	13.95
6840	11.95
6843	33.95
6844	24.95
6845	13.95
6847	10.95
6850	3.20
6852	15.70
6860	9.90
6862	10.95
6875	6.90
6880	2.20
6883	21.95
68047	23.95
68488	18.95

## 6800 1MHZ

68B00	9.95
68B02	21.25
68B09E	28.95
68B09	28.95
68B10	6.90
68B21	6.90
68B45	18.95
68B50	5.90

## 8000

8035	5.90
8039	6.90
INS-8060	16.95
INS-8073	23.95
8080	3.90
8085	5.90
8085A-2	10.95
8086	28.95
8087	CALL
8088	38.95
8089	88.95
8155	6.90
8155-2	7.90
8156	6.90
8185	28.95
8185-2	38.95
8741	38.95
8748	23.95
8755	23.95



## 8200

8202	23.95
8203	38.95
8205	3.45
8212	1.75
8214	3.80
8216	1.70
8224	2.20
8226	1.75
8228	3.45
8237	18.95
8237-5	20.95
8238	4.45
8243	4.40
8250	9.95
8251	4.45
8253	6.90
8253-5	7.90
8255	4.45
8255-5	5.20
8257	7.90
8257-5	8.90
8259	6.85
8259-5	7.45
8271	38.95
8272	38.95
8275	28.95
8279	8.90
8279-5	9.00
8272	6.45
8283	6.45
8284	5.45
8286	6.45
8287	6.45
8288	24.00
8289	48.95

## Z-80

### 2.5 Mhz

Z80-CPU	3.90
Z80-CTC	4.45
Z80-DART	9.95
Z80-DMA	13.95
Z80-PIO	4.45
Z80-SIO/0	15.95
Z80-SIO/1	15.95
Z80-SIO/2	15.95
Z80-SIO/9	15.95

### 4.0 Mhz

Z80A-CPU	4.90
Z80A-CTC	4.90
Z80A-DART	10.95
Z80A-DMA	15.95
Z80A-PIO	4.90
Z80A-SIO/0	15.95
Z80A-SIO/1	15.95
Z80A-SIO/2	15.95
Z80A-SIO/9	15.95

### 6.0 Mhz

Z80B-CPU	12.95
Z80B-CTC	12.95
Z80B-PIO	12.95
Z80B-DART	18.95

## ZILOG

Z6132	33.95
Z8671	38.95

## DISC CONTROLLERS

1771	15.95
1791	23.95
1793	25.95
1795	48.95
1797	48.95
2791	53.95
2793	53.95
2795	58.95
2797	58.95
6843	33.95
8272	38.95
UPD765	38.95
MB8876	28.95
MB8877	33.95
1691	16.95
2143	17.95

## UARTS

AY3-1014	6.90
AY5-1013	3.90
AY3-1015	6.90
PT-1472	9.90
TR1602	3.90
2350	9.90
2651	8.90
TMS6011	5.90
IM6402	7.90
IM6403	8.90
INS8250	9.95

## INTERFACE

8T26	1.54
8T28	1.84
8T95	.88
8T96	.88
8T97	.88
8T98	.88
DM6131	2.90
DP8304	2.24
DS8835	1.94
DS8836	.98

## VOLTAGE REGULATORS

7805T	.74	7805T	.84
78M05C	.34	7808T	.84
7808T	.74	7812T	.84
7812T	.74	7815T	.84
7815T	.74	7824T	.84
7824T	.74	7805K	1.44
7805K	1.34	7812K	1.44
7812K	1.34	7815K	1.44
7815K	1.34	7824K	1.44
7824K	1.34	78L05	.78
78L05	.68	78L12	.78
78L12	.68	78L15	.78
78L15	.68	LM323K	4.90
78H05K	9.90	UA78S40	1.90
78H12K	9.90		

C,T = TO-220 K = TO-3 L = TO-92

## DIP SWITCHES

4 POSITION	.84
5 POSITION	.89
6 POSITION	.89
7 POSITION	.94
8 POSITION	.94

## IC SOCKETS

	1.99	100
8 pin ST	.12	.10
14 pin ST	.14	.11
16 pin ST	.16	.12
18 pin ST	.19	.17
20 pin ST	.28	.26
22 pin ST	.29	.26
24 pin ST	.29	.26
28 pin ST	.39	.31
40 pin ST	.48	.38
64 pin ST	4.20	call

### ST = SOLDERTAIL

8 pin WW	.58	.48
14 pin WW	.68	.51
16 pin WW	.68	.57
18 pin WW	.98	.89
20 pin WW	1.04	.97
22 pin WW	1.34	1.23
24 pin WW	1.44	1.30
28 pin WW	1.64	1.44
40 pin WW	1.94	1.75

### WW = WIREWRAP

16 pin ZIF	6.70	call
24 pin ZIF	9.90	call
28 pin ZIF	9.95	call

ZIF = TEXTTOOL (Zero Insertion Force)

## CRYSTALS

32.768khz	1.90
1.0 mhz	4.90
1.8432	4.90
2.0	3.90
2.097152	3.90
2.4576	3.90
3.2768	3.90
3.579535	3.90
4.0	3.90
5.0	3.90
5.0688	3.90
5.185	3.90
5.7143	3.90
6.0	3.90
6.144	3.90
6.5536	3.90
8.0	3.90
10.0	3.90
10.738635	3.90
14.31818	3.90
15.0	3.90
16.0	3.90
17.430	3.90
18.0	3.90
18.432	3.90
20.0	3.90
22.1184	3.90
32.0	3.90

## RESISTORS

1/4 WATT 5% CARBON FILM ALL STANDARD VALUES FROM 1 OHM TO 10 MEG OHM

50 PCS.	1.25
100 PCS.	2.00
1000 PCS.	15.00

## APPLE ACCESSORIES

80 Column Card	129.95
16 K Card	42.50
Fan	38.95
Power Supply	84.95
RF Mod	24.95
Joy Stick (Apple II)	29.95
Paddles Apple	9.95
Z80 Card	129.95
SCRG Switch-A-Slot	19.95
Paddle Adapple	24.95
Extend-A Slot	19.95
Disk Drive	224.95
Controller Card	69.95

## 5 1/4" DISKETTES

### ATHANA OR NASHUA

SSSD	18.95
SSDD	22.95
DSDD	27.95

## PERISOFT

ACCESSORIES FOR APPLE II & IIe  
ALL WITH 1 YEAR WARRANTY BY

### PRINTERLINK CENTRONICS PARALLEL INTERFACE

- Simple to use — No configuring required
- Use with any centronics printer — EPSON, OKIDATA, etc.
- Includes Cable & Manual

**\$58<sup>00</sup>**

### MESSANGER SERIAL INTERFACE

- Connects to any RS-232 serial device
- 8 switch selectable drivers for printers, terminals and modems
- Includes Cable & Manual

**\$98<sup>00</sup>**

### TIMELINK REAL TIME CLOCK

- Applications in file management, word processing, communications, etc.
- Exclusive Alarm Clock feature
- Battery recharges automatically

**\$83<sup>00</sup>**

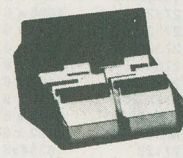
### NEW BUFFERLINK ADD-ON PRINTER BUFFER

- No more waiting for printed output
- Connects easily to any parallel interface
- Expandable from 16K to 64K

**\$138<sup>00</sup> (16K)**

## The Flip Sort™

The new Flip Sort™ has all the fine qualities of the original Flip Sort™, with some added benefits. Along with a new design, capacity has increased 50%, to hold 75 diskettes and the price is more reasonable than ever. **\$19.95 ea.**



## The Flip Sort Plus™

The Flip Sort Plus™ adds new dimensions to storage. Designed with similar elegant lines as the original Flip Sort™, in a transparent smoked acrylic. The Flip Sort Plus™ has a storage capacity of over 100 diskettes and has all the outstanding features you have come to expect from the flip sort Family. **24.95 each**

# DoKay

2100 De La Cruz Blvd.  
Santa Clara, CA 95050







**2114** 450 NS **8/\$995**

**2114** 250 NS **8/\$1095**

### 7400

7400	.19	74132	.45
7401	.19	74136	.50
7402	.19	74141	.65
7403	.19	74142	2.95
7404	.19	74143	2.95
7405	.25	74145	.60
7406	.29	74147	1.75
7407	.29	74148	1.20
7408	.24	74150	1.35
7409	.19	74151	.55
7410	.19	74152	.65
7411	.25	74153	.55
7412	.30	74154	1.25
7413	.35	74155	.75
7414	.49	74156	.65
7416	.25	74157	.55
7417	.25	74159	1.65
7420	.19	74160	.85
7421	.35	74161	.69
7422	.35	74162	.85
7423	.29	74163	.69
7425	.29	74164	.85
7426	.29	74165	.85
7427	.29	74166	1.00
7428	.45	74167	2.95
7430	.19	74170	1.65
7432	.29	74172	5.95
7433	.45	74173	.75
7437	.29	74174	.89
7438	.29	74175	.89
7440	.19	74176	.89
7442	.49	74177	.75
7443	.65	74178	1.15
7444	.69	74179	1.75
7445	.69	74180	.75
7446	.69	74181	2.25
7447	.69	74182	.75
7448	.69	74184	2.00
7450	.19	74185	2.00
7451	.23	74190	1.15
7453	.23	74191	1.15
7454	.23	74192	.79
7460	.23	74193	.79
7470	.35	74194	.85
7472	.29	74195	.85
7473	.34	74196	.79
7474	.33	74197	.75
7475	.45	74198	1.35
7476	.35	74199	1.35
7480	.59	74221	1.35
7481	1.10	74246	1.35
7482	.95	74247	1.25
7483	.50	74248	1.85
7485	.59	74249	1.95
7486	.35	74251	.75
7489	2.15	74259	2.25
7490	.35	74265	1.35
7491	.40	74273	1.95
7492	.50	74276	1.25
7493	.35	74279	.75
7494	.65	74283	2.00
7495	.55	74284	3.75
7496	.70	74285	3.75
7497	2.75	74290	.95
74100	1.75	74293	.75
74107	.30	74298	.85
74109	.45	74351	2.25
74110	.45	74365	.65
74111	.55	74366	.65
74116	1.55	74367	.65
74120	1.20	74368	.65
74121	.29	74376	2.20
74122	.45	74390	1.75
74123	.49	74393	1.35
74125	.45	74425	3.15
74126	.45	74426	.85
74128	.55	74490	2.55

### LINEAR

LM301	.34	LM340 (see 7800)	LM566	1.49	LM1800	2.37	
LM301H	.79	LM348	.99	LM567	.89	LM1812	8.25
LM307	.45	LM350K	4.95	NE570	3.95	LM1830	3.50
LM308	.69	LM350T	4.60	NE571	2.95	LM1871	5.49
LM308H	1.15	LM358	.69	NE592	2.75	LM1872	5.49
LM309H	1.95	LM359	1.79	LM709	.59	LM1877	3.25
LM309K	1.25	LM376	3.75	LM710	.75	LM1889	1.95
LM310	1.75	LM377	1.95	LM711	.79	LM1896	1.75
LM311	.64	LM378	2.50	LM723	.49	ULN2003	2.49
LM311H	.89	LM379	4.50	LM723H	.55	LM2877	2.05
LM312H	1.75	LM380	.89	LM733	.98	LM2878	2.25
LM317K	3.95	LM380N-8	1.10	LM741	.35	LM2900	.85
LM317T	1.19	LM381	1.60	LM741N-14	.35	LM2901	1.00
LM318	1.49	LM382	1.60	LM741H	.40	LM3900	.59
LM318H	1.59	LM383	1.95	LM747	.69	LM3905	1.25
LM319H	1.90	LM384	1.95	LM748	.59	LM3909	.98
LM319	1.25	LM386	.89	LM1014	1.19	LM3911	2.25
LM320 (see 7900)	LM387	1.40	LM1303	1.95	LM3914	3.95	
LM322	1.65	LM389	1.35	LM1310	1.49	LM3915	3.95
LM323K	4.95	LM390	1.95	MC1330	1.69	LM3916	3.95
LM324	.59	LM392	.69	MC1349	1.89	MC4024	3.95
LM329	.65	LM394H	4.60	MC1350	1.19	MC4044	4.50
LM331	3.95	LM399H	5.00	MC1358	1.69	RC4136	1.25
LM334	1.19	NE531	2.95	MC1372	6.95	RC4151	3.95
LM335	1.40	NE555	.34	LM1414	1.59	LM4250	1.75
LM336	1.75	NE556	.65	LM1458	.59	LM4500	3.25
LM337K	3.95	NE558	1.50	LM1488	.69	RC4558	.69
LM337T	1.95	NE561	24.95	LM1489	.69	LM13080	1.29
LM338K	6.95	NE564	2.95	LM1496	.85	LM13600	1.49
LM339	.99	LM565	.99	LM1558H	3.10	LM13700	1.49

H = TO-5 CAN

T = TO-220

K = TO-3

### RCA

CA 3023	2.75	CA 3082	1.65
CA 3039	1.29	CA 3083	1.55
CA 3046	1.25	CA 3086	.80
CA 3059	2.90	CA 3089	2.99
CA 3060	2.90	CA 3096	3.49
CA 3065	1.75	CA 3130	1.30
CA 3080	1.10	CA 3140	1.15
CA 3081	1.65	CA 3146	1.85
CA 3160	1.19		

### TI

TL494	4.20	75365	1.95
TL496	1.65	75450	.59
TL497	3.25	75451	.39
75107	1.49	75452	.39
75110	1.95	75453	.39
75150	1.95	75454	.39
75154	1.95	75491	.79
75188	1.25	75492	.79
75189	1.25	75493	.89
75494	.89		

### BI FET

TL071	.79	TL084	2.19
TL072	1.19	LF347	2.19
TL074	2.19	LF351	.60
TL081	.79	LF353	1.00
TL082	1.19	LF355	1.10
TL083	1.19	LF356	1.10
LF357	1.40		

### CMOS

4000	.29	4527	1.95
4001	.25	4528	1.19
4002	.25	4531	.95
4006	.89	4532	1.95
4007	.29	4538	1.95
4008	.95	4539	1.95
4009	.39	4541	2.64
4010	.45	4543	1.19
4011	.25	4553	5.79
4012	.25	4555	.95
4013	.38	4556	.95
4014	.79	4581	1.95
4015	.39	4582	1.95
4016	.39	4584	.75
4017	.69	4585	.75
4018	.79	4702	12.95
4019	.39	74C00	.35
4020	.75	74C02	.35
4021	.79	74C04	.35
4022	.79	74C08	.35
4023	.29	74C10	.35
4024	.65	74C14	.59
4025	.29	74C20	.35
4026	1.65	74C30	.35
4027	.45	74C32	.39
4028	.69	74C42	1.29
4029	.79	74C48	1.99
4030	.39	74C73	.65
4034	1.95	74C74	.65
4035	.85	74C76	.80
4040	.75	74C83	1.95
4041	.75	74C85	1.95
4042	.69	74C86	.39
4043	.85	74C89	4.50
4044	.79	74C90	1.19
4046	.85	74C93	1.75
4047	.95	74C95	.89
4049	.35	74C107	.89
4050	.35	74C150	5.75
4051	.79	74C151	2.25
4053	.79	74C154	3.25
4060	.89	74C157	1.75
4066	.39	74C160	1.19
4068	.39	74C161	1.19
4069	.29	74C162	1.19
4070	.35	74C163	1.19
4071	.29	74C164	1.39
4072	.29	74C165	2.00
4073	.29	74C173	.79
4075	.29	74C174	1.19
4076	.79	74C175	1.19
4078	.29	74C192	1.49
4081	.29	74C193	1.49
4082	.29	74C195	1.39
4085	.95	74C200	5.75
4086	.95	74C221	1.75
4093	.49	74C373	2.45
4098	2.49	74C374	2.45
4099	1.95	74C901	.39
14409	12.95	74C902	.85
14410	12.95	74C903	.85
14411	11.95	74C905	10.95
14412	12.95	74C906	.95
14419	7.95	74C907	1.00
14433	4.18	74C908	2.00
4502	.95	74C909	2.75
4503	.65	74C910	9.95
4508	1.95	74C911	8.95
4510	.85	74C912	8.95
4511	.85	74C914	1.95
4512	.85	74C915	1.19
4514	1.25	74C918	2.75
4515	1.79	74C920	17.95
4516	1.55	74C921	15.95
4518	.89	74C922	4.49
4519	.39	74C923	4.95
4520	.79	74C925	5.95
4522	1.25	74C926	7.95
4526	1.25	74C928	7.95
		74C929	19.95

### 74S00

74S00	.32	74S163	1.95
74S02	.35	74S168	3.95
74S03	.35	74S169	3.95
74S04	.35	74S174	.95
74S05	.35	74S175	.95
74S08	.35	74S181	3.95
74S09	.40	74S182	2.95
74S10	.35	74S188	1.95
74S11	.35	74S189	6.95
74S15	.35	74S194	1.49
74S20	.35	74S195	1.49
74S22	.35	74S196	1.49
74S30	.35	74S197	1.49
74S32	.40	74S201	6.95
74S37	.88	74S225	7.95
74S38	.85	74S240	2.20
74S40	.35	74S241	2.20
74S51	.35	74S244	2.20
74S64	.40	74S251	.95
74S65	.40	74S253	.95
74S74	.50	74S257	.95
74S85	1.99	74S258	.95
74S86	.50	74S260	.79
74S112	.50	74S274	19.95
74S113	.50	74S275	19.95
74S114	.55	74S280	1.95
74S124	2.75	74S287	1.90
74S132	1.24	74S288	1.90
74S133	.45	74S289	6.89
74S134	.50	74S301	6.95
74S135	.89	74S373	2.45
74S138	.85	74S374	2.45
74S139	.85	74S381	7.95
74S140	.55	74S387	1.95
74S151	.95	74S412	2.98
74S153	.95	74S471	4.95
74S157	.95	74S472	4.95
74S158	.95	74S474	4.95
74S161	1.95	74S482	15.25
74S162	1.95	74S570	2.95
		74S571	2.95



## CABINETS FOR 5 1/4" DISK DRIVES

### CABINET #1 \$29.95

- \* DIMENSIONS 8 3/8 x 5 1/8 x 3 1/8"
- \* COLOR MATCHES APPLE
- \* FITS STANDARD 5 1/4" DRIVES, INCL. SHUGART
- \* INCLUDES MOUNTING HARDWARE AND FEET

### CABINET #2 \$79.00

- \* COMPLETE WITH POWER SUPPLY, SWITCH, LINE CORD, FUSE & STANDARD POWER CONNECTOR
  - \* DIMENSIONS: 11 1/2 x 5 3/4 x 3 1/8"
  - \* +5V @ 1 AMP, +12V @ 1.5 AMP
  - \* FITS STANDARD 5 1/4" DRIVES
  - \* PLEASE SPECIFY GRAY OR TAN
- NOTE: Please include sufficient amount for shipping on above items.

## CONNECTORS

RS232 MALE	2.50
RS232 FEMALE	3.25
RIGHT ANGLE	5.25
RS232 HOOD	1.25
S-100 ST	3.95
S-100 WW	4.95
72 pin ST	6.95
72 pin WW	7.95
50 pin ST	4.95
44 pin ST	2.95
44 pin WW	4.95
72 pin SE	3.95

## MUFFIN FANS

### NEW UN-USED

4.68" Square	14.95
3.125" Square	14.95

## OPTO-ISOLATORS

4N26	1.00
4N27	1.10
4N28	.69
4N33	1.75
4N35	1.25
4N37	1.25
MCT-2	1.00
MCT-6	1.50
MCA-7	4.25
MCA-255	1.75
IL-1	1.25
ILA-30	1.25
ILQ-74	2.75
H11C5	1.25
TIL-111	1.00
TIL-113	1.75

## TRANSISTORS

2N918	.50	MPS3706	.15
MPS918	.25	2N3772	1.85
2N2102	.70	2N3903	.25
2N2218	.50	2N3904	.10
2N2218A	.50	2N3906	.10
2N2219	.50	2N4122	.25
2N2219A	.50	2N4123	.25
2N2222	.25	2N4249	.25
PN2222	.10	2N4304	.75
MPS2369	.25	2N4401	.25
2N2484	.25	2N4402	.25
2N2905	.50	2N4403	.25
2N2907	.25	2N4857	1.00
PN2907	.125	PN4916	.25
2N3055	.79	2N5086	.25
3055T	.69	PN5129	.25
2N3393	.30	PN5139	.25
2N3414	.25	2N5209	.25
2N3563	.40	2N6028	.35
2N3565	.40	2N6043	1.75
PN3565	.25	2N6045	1.75
MPS3638	.25	MPS-A05	.25
MPS3640	.25	MPS-A06	.25
PN3643	.25	MPS-A55	.25
PN3644	.25	TIP29	.65
MPS3704	.15	TIP31	.75
		TIP32	.79

## MICROCOMPUTER HARDWARE HANDBOOK FROM ELCOMP — \$14.95

Over 800 pages of manufacturers data sheets on most commonly used IC's.

Includes:

- \* TTL — 74/74LS and 74F
- \* CMOS
- \* Voltage Regulators
- \* Memory — RAM, ROM, EPROM
- \* CPU's — 6800, 6500, Z80, 8080, 8085, 8086/8
- \* MPU support & interface — 6800, 6500, Z80, 8200, etc.

## HEAT SINKS

TO-3 style	.95
TO-220 style	.35

## DISK DRIVES TANDON

TM100-1 5 1/4" (FOR IBM) SS/DD 229.00

TM100-2 5 1/4" (FOR IBM) DS/DD 295.00

## SHUGART

SA 400L 5 1/4" (40 TRACK) SS/DD 199.95

SA 400 5 1/4" (35 TRACK) SS/DD 189.95

## SIEMENS

FD100-8 8" SS/DD (SHUGART 801 EQUIVALENT) 189.00

FD200-8 8" DS/DD (SHUGART 851 EQUIVALENT) 239.00

## PERTEC

FD-200 5 1/4" SS/DD 179.95

FD-250 5 1/4" DS/DD 199.95

## MPI

MP-52 5 1/4" (FOR IBM) DS/DD 295.00

NOTE: Please include sufficient amount for shipping on above items.

## RESISTORS

1/4 WATT 5% CARBON FILM ALL STANDARD VALUES FROM 1 OHM TO 10 MEG OHM

50 PCS. SAME VALUE	.025
100 PCS. SAME VALUE	.02
1000 PCS. SAME VALUE	.015

## BYPASS CAPS

.01 UF DISC	100/6.00
.1 UF DISC	100/8.00
.1 UF MONOLITHIC	100/15.00

**WE HAVE THE COMPLETE LINE OF DISC, TANTALUM AND ELECTROLYTIC CAPACITORS IN STOCK!**

## POWER SUPPLY MODEL 2 \$39.95

MOUNTED ON PC BOARD MANUFACTURED BY CONVER

+5 VOLT 4 AMP

±12 VOLT 1 AMP

NOTE: Please include sufficient amount for shipping on above items.

## DIODES

1N751	5.1 volt zener	.25
1N759	12.0 volt zener	.25
1N4148	(1N914) switching	25/1.00
1N4004	400PIV rectifier	10/1.00
KBP02	200PIV 1.5amp bridge	.45
KBP04	400PIV 1.5amp bridge	.55
VM48	Dip-Bridge	.35

## D-SUBMINIATURE

DESCRIPTION	SOLDER CUP		RIGHT ANGLE PC SOLDER		IDC RIBBON CABLE		HOODS	
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	BLACK	GREY
ORDER BY	DBxxP	DBxxS	DBxxPR	DBxxSR	IDBxxP	IDBxxS	HOOD-B	HOOD
CONTACTS 9	2.08	2.66	1.65	2.18	3.37	3.69	---	1.60
15	2.69	3.63	2.20	3.03	4.70	5.13	---	1.60
25	2.50	3.25	3.00	4.42	6.23	6.84	1.25	1.25
37	4.80	7.11	4.83	6.19	9.22	10.08	---	2.95
50	6.06	9.24	---	---	---	---	---	3.50

For order instructions see "IDC Connectors" below.

**CALL FOR MOUNTING HARDWARE**

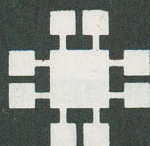
## RIBBON CABLE

CONTACTS	SINGLE COLOR		COLOR CODED	
	1'	10'	1'	10'
10	.50	4.40	.83	7.30
16	.55	4.80	1.00	8.80
20	.65	5.70	1.25	11.00
25	.75	6.60	1.32	11.60
26	.75	6.60	1.32	11.60
34	.98	8.60	1.65	14.50
40	1.32	11.60	1.92	16.80
50	1.38	12.10	2.50	22.00

## IDC CONNECTORS

DESCRIPTION	SOLDER HEADER	RIGHT ANGLE SOLDER HEADER	WW HEADER	RIGHT ANGLE WW HEADER	RIBBON HEADER SOCKET	RIBBON HEADER	RIBBON EDGE CARD
ORDER BY	IDHxxS	IDHxxSR	IDHxxW	IDHxxWR	IDSxx	IDMxx	IDExx
CONTACTS 10	.82	.85	1.86	2.05	1.15	---	2.25
20	1.29	1.35	2.98	3.28	1.86	5.50	2.36
26	1.68	1.76	3.84	4.22	2.43	6.25	2.65
34	2.20	2.31	4.50	4.45	3.15	7.00	3.25
40	2.58	2.72	5.28	4.80	3.73	7.50	3.80
50	3.24	3.39	6.63	7.30	4.65	8.50	4.74

**ORDERING INSTRUCTIONS:** Insert the number of contacts in the position marked "xx" of the "order by" part number listed. **Example:** A 10 pin right angle solder style header would be IDH10SR.



**JDR Microdevices**

1224 S. Bascom Avenue  
San Jose, CA 95128

800-538-5000 • 800-662-6279 (CA)  
(408) 995-5430 • Telex 171-110

1983 JDR MICRODEVICES, INC.

**VISIT OUR RETAIL STORE**

**— NEW HOURS —**  
M-W-F, 9-5  
T-Th., 9-9 Sat. 11-3

PLEASE USE YOUR CUSTOMER NUMBER WHEN ORDERING

**TERMS:** For shipping include \$2 for UPS Ground or \$3 for UPS Blue Label Air. Items over 5 pounds require additional shipping charges. Foreign orders include sufficient amount for shipping. There is a \$10 minimum order. Bay Area and Los Angeles Counties add 6% Sales Tax. Other California residents add 6% Sales Tax. We reserve the right to substitute manufacturer. Not responsible for typographical errors. Prices are subject to change without notice. We will match or beat any competitor's price provided it is not below our cost.



# FOR APPLE COMPUTER USERS

## FD-35 DISK DRIVE

- ★ Direct Replacement for Apple Disk II
- ★ Compatible with Apple Controller or other Apple compatible controllers
- ★ Specially designed electronics with **low power consumption**
- ★ DOS 3.3 and 3.2 compatible
- ★ Owner's Manual and Warranty Card included

**NOW**  
**WITH ONE YEAR WARRANTY**  
**\$229<sup>95</sup>**  
**CONTROLLER CARD \$89.95**

## VIEWMAX-80

- A Full Function**  
 80 Column Card for Apple II\*  
 ★ Soft Video Switch ★ Shift Key Support  
**2 YEAR WARRANTY**

**NOW ONLY \$189<sup>95</sup>**

## 5 1/4" DISKETTES VERBATIM DATALIFE

**SS/DD** SOFT SECTOR . . . . . **29.95**

**SS/DD** 10 SECTOR HEAD . . . . **29.95**

## NASHUA

**SS/DD** SOFT SECTOR  
 WITH HUB RING . . . . . **\$19<sup>95</sup>**

Ask about our full  
 line of Nashua diskettes

**BEST BUY**

## THOUSANDS SOLD

### JDR 16K RAMCARD

- ★ Expand your 48K Apple to 64K
- ★ Fully compatible with Apple Language System — Use in place of Apple Language card
- ★ Provides extra memory for Visicalc™
- ★ Run PASCAL, FORTRAN, Integer Basic with appropriate software
- ★ Highest quality card features: gold edge connector, sockets for all IC's

**WITH 2 YEAR WARRANTY**

**ASSEMBLED & TESTED  
 WITH WARRANTY . . . . . \$44<sup>95</sup>**

**KIT — INCLUDES ALL  
 PARTS & INSTRUCTIONS \$40<sup>95</sup>**

**BARE PC CARD  
 WITH INSTRUCTIONS . . . . \$14<sup>95</sup>**

## APPLE COMPATIBLE

### POWER SUPPLY \$99.95

- ★ Compact Switching Design
- ★ All Outputs regulated
- ★ Short Circuit and Overload Protection
- ★ Complete with Apple-type plug-in power cord
- ★ Apple Compatible — Yet higher output allows more disk drives and cards without overheating
- ★ +5V @ 5A, +12V @ 3A, -5V @ .5A, -12V @ .5A
- ★ Shielded enclosure: 10 3/4" x 3 1/2" x 2 1/8"

## NEW IMPROVED JDR COOLING FAN

- ★ Easy modification — no modification of Apple required
- ★ Eliminates overheating problems
- ★ Switch on front controls fan, Apple, and extra outlet
- ★ Rotron whisper fan is the quietest, most reliable on the market

### NOW WITH SURGE SUPPRESSION

**\$69.95**

**WITHOUT SURGE  
 SUPPRESSION \$59.95**

## MONITORS MONOCHROME

**NEC JB1201M - 20 MHZ GREEN \$169**

**ZENITH ZUM-121 - 15 MHZ GREEN \$99**

**TAXAN 18 MHZ AMBER \$139**

## COLOR

**AMDEK COLOR I - COMPOSITE \$335**

NO C.O.D. ORDERS PLEASE

## ORDER TOLL FREE

**800-538-5000**

**800-662-6279**

**(CALIFORNIA RESIDENTS)**

## ACCESSORIES FOR APPLE II & IIE

**ALL WITH 1 YEAR WARRANTY BY**



### PRINTERLINK

**CENTRONICS  
 PARALLEL INTERFACE**

- ★ Simple to use — No configuring required
- ★ Use with any centronics printer — EPSON, OKIDATA, etc.
- ★ Includes Cable & Manual

**\$59<sup>00</sup>**

### MESSENGER

**SERIAL  
 INTERFACE**

- ★ Connects to any RS-232 serial device
- ★ 8 switch selectable drivers for printers, terminals and modems
- ★ Includes Cable & Manual

**\$99<sup>00</sup>**

### TIMELINK

**REAL TIME  
 CLOCK**

- ★ Applications in file management, word processing, communications, etc.
- ★ Exclusive Alarm Clock feature
- ★ Battery recharges automatically

**\$84<sup>00</sup>**

### NEW BUFFERLINK

**ADD-ON  
 PRINTER BUFFER**

- ★ Saves Time — No more waiting for printed output
- ★ Connects easily to any parallel interface
- ★ Expandable from 16K to 64K

**\$139<sup>00</sup> (16K)**

**ORDER TOLL FREE**

**ALL MERCHANDISE  
 100% GUARANTEED**

**800-538-5000**



1983 JDR MICRODEVICES, INC.

**800-662-6279**

**(CALIFORNIA RESIDENTS)**

**CALL US FOR VOLUME QUOTES**





# Active Electronics

**NUMBER ONE IN  
QUALITY  
SERVICE  
AVAILABILITY**

**THE WORLD'S MOST  
COMPLETE PROFESSIONAL  
AND HOME ELECTRONICS  
ENTHUSIAST INVENTORY**

- \* Semiconductors + Memories
- \* Microprocessors + Support Circuits
- \* Microcomputer Systems + Peripherals
- \* Passive Electronic Components
- \* Hand Tools, Wire Wrapping, Soldering Equipment + Hardware

**NOW AVAILABLE — FREE  
1983 80-page catalog**

A complete listing of products and specifications

Call, write or circle the inquiry card for your free copy today.

P.O. Box 8000, Westboro, Mass. 01581  
**CALL TOLL FREE: 1-800-343-0874**

Mass customers call (617) 366-0500

CIRCLE 3 ON FREE INFORMATION CARD

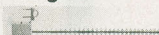
## MICROWAVE RECEIVER 1.9-2.5 GHz



- 50 dB gain
- 50 mile line of sight
- Complete power supply, cable antenna and probe.

RK-1 Assembled ... \$114.95  
RK-1 Kit Form ... \$ 84.95

## MICROWAVE RECEIVER 1.9-2.5 GHz



- Rod style
- 30 mile reception
- Complete system
- 32 element antenna
- Kit or assembled

RK-3 Assembled ... \$79.95  
RK-3 Kit ... \$64.95

## MICROWAVE PREAMP KIT!!!

Use with RK-3 Kit. Add's 20-25 dB gain.

- Increase reception
- Low noise
- Use with all existing stop sign board receivers

MP-4 Kit ... \$38.95

**GAMMA ELECTRONICS**  
455 Massachusetts Ave.  
Arlington, MA 02174

**AD-1 PULSEWAVE  
Pulsewave Kit  
and Enclosure ... \$119.95**  
AD-1 Board Only ... \$19.95

## UHF TV PREAMP

A very popular UHF Preamp Kit. Astounding signal amplification.

Features:

- 27 dB gain
- 2 dB noise factor
- 75 ohm input/output
- Enclosure & power supply included



CD-1 Preamp Kit ... \$34.95

## DIGITAL METER MIC-3300A



- Assembled • 3 1/2 digits • DC .5% accuracy • DCA up to 10 amps • Ohm up to 20 M ohm • hFE measurement • Floating decimal point • Leads + battery included

A high quality Digital Meter at an affordable price, the MIC 3300A is a high quality meter for all hobbyists and maintenance work.

MIC-3300A ... \$59.95  
Carrying Case ... \$ 9.95

## LOGIC PROBE



- Troubleshoot TTL-CMOS
- 4 LED states
- High input impedance
- Flexible clip on power leads
- Assembled & tested

L101A Logic Probe . \$34.95

**TO ORDER CALL:**  
1-617-641-0778



CIRCLE 98 ON FREE INFORMATION CARD

## CABLE TV EQUIPMENT

Complete with Descrambler  
60 Channel Wireless  
Remote Control

Jerrald, Oak, Hamlin  
Become a Cable TV Giant in  
your Town and Get in on The  
Big Profits.

Send or Call for Information on  
our Dealer Catalog and Special  
Pricing, Territories.



Satellite TV  
Earth Station  
Installed

**\$2,895<sup>00</sup>**

**Long Island Wholesale**  
37 Sherwood St.,  
Greenwich, CT 06830  
For Cable Info Call  
203-869-2091

The Use of Some Cable TV Equipment is Illegal. Check With Your Own Local Cable Co. Before Ordering. We Except No Liability for your Misuse.

## VIDEO EQUIPMENT



- 8 Event / 14 Day Programmability
- Hi-Speed Search in Forward and Reverse

- 10 Function Remote Control
- Electronic Tuning
- 4 Video Heads
- 2-4-6 Hour Play Back

V.C.R. - VHS **\$569<sup>00</sup>**

## AUTO EQUIPMENT

Page Alert 4000

A Vehicle Theft Warning System By Radio Signal to Your Personal Pocket Receiver.  
1 Mile Range.

**\$69<sup>00</sup>**



- Distribution Amp
- Most Advanced State of the Art
- Money Back Guarantee
- Stabilizer
- Image Enhancer
- Video Fader

VIDEO PROCESSING  
CENTER **\$139<sup>95</sup>**



Car Stereo and Home Stereo  
By Audio Vox, Jensen, Pioneer  
Clarion, Akai  
Send For Wholesale Dealer Catalog

Radar  
Detector



Fox  
Fuzz Buster  
Bell  
**\$69<sup>00</sup>** And Up

## CORDLESS PHONE

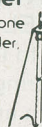


700  
Deluxe  
Range  
By Midland

Basic Model

**\$89<sup>00</sup>**  
**\$79<sup>00</sup>**

Tele-Ranger  
Wireless Telephone  
Range Extender.  
Complete



**\$49<sup>00</sup>**

## Audio Whizz

Is Like Having Your Own  
Radio Station it Transmits  
Your Music Anywhere

In Your Home or Yard  
(Wireless Theater Sound)

**Long Island Public Wholesale**  
270 Islip Ave.,  
Islip, NY 11751  
516-581-7232  
516-277-4232

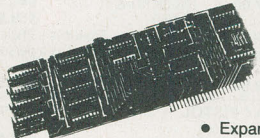
CIRCLE 44 ON FREE INFORMATION CARD



# ADVANCED COMPUTER PRODUCTS

SEND \$2.00 for 1983 CATALOG

## 16K Apple™ Ramcard



LIST 195  
ACP  
\$49<sup>95</sup>

- With 80 Columns
- Expand Apple II 48K to 64K
- Compatible with Z-80 Softcard™
- Top quality — gold fingers
- Full 1 year warranty

## 64K Apple IIe Ramcard

• Also with 80 Columns . . . only \$99<sup>95</sup>

## RAM UP-GRADES

64K D RAM (4164-200nS)

9 pcs for \$50<sup>00</sup>

16K D RAM (4116-200nS)

8 pcs for \$12<sup>95</sup>

## REPEAT OF SELL-OUT

58 Key Unencoded Keyboard



\$19<sup>95</sup> ea.

This is a new 58 key terminal Keyboard manufactured by a major manufacturer. It is unencoded with SPST keys unattached to any PC board. Solid molded plastic base measures 11" x 4".

## Unencoded Key Pad

15 key Keypad with 1-10 keys and tab, return, (-), (+) and (.).  
Only \$9<sup>95</sup> ea.

## UV "EPROM" ERASER

Model DE-4  
Holds 4 EPROM's at a time.  
Model S-52T \$325.00



Model S-52T \$325.00

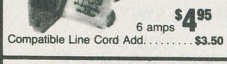
## 32K S-100 Static RAM Kit

4 MHz  
Uses 2114L  
ACP Price \$129<sup>00</sup>



## CORCOM FILTER

Popular CORCOM Filter  
6 amps \$4<sup>95</sup>  
Compatible Line Cord Add. . . . . \$3.50



## AMD MODEM IC

P/N AM7910  
1200 Baud  
5 Volts  
Special ACP Pricing \$69<sup>00</sup>



## STEPPER MOTOR

Operates by applying 12VDC in one direction and then reversing polarity (or square wave). Uses 12VDC. Clock Wise Rotation. Rated 3 RPM at 4 P.P.S. with a 5 degree stepping angle.



ACP Price \$3<sup>95</sup>  
10 for \$34.95

## RS232 SIGNAL TESTER

COEX RS232 LINE TESTER (7) LED Indicators  
Only \$24<sup>95</sup>  
Other Styles Also Available



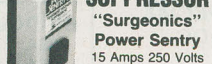
## 64K CMOS RAMCARD

IEEE Compatible  
Uses Low Power 6116 IC's  
5V Single Supply  
Asm and Tested . . . \$299<sup>00</sup>



## SURGE SUPPRESSOR

"Surgeonics" Power Sentry  
15 Amps 250 Volts transient suppression  
ACP Low Price \$39<sup>95</sup>



## CONNECTORS



DB25P (RS232) \$3.25  
DB25S Female 3.75  
Hood 1.25  
Set with Hood, Sale 7.50  
22/44 S/T, KIM 2.95  
43/86 S/T, MOT 6.50  
50/100 S-100 Connector W/W 4.95  
50/100 S-100 Connector S/T 3.95



## COEX 80-FT DOT MATRIX PRINTER

• 9x7 Dot Matrix, 80 CPS, Bi-Directional Printing  
• 2K Buffered Memory  
• 80, 96, 132 Columns, Graphics and Block Printing  
• Selectable Char Pitch, Line Spacing and Feed  
• COEX Interface Card to Apple . . . \$49.95  
• Commodore Interface Card to VIC, 64, PET . . . \$79.95



\$199<sup>00</sup>

## MICROPROCESSORS

Z8001	\$44.95	8008-1	\$14.95	6802P	\$7.95
Z8002	\$1.95	2801	6.95	8035	5.95
Z80	3.95	2801A	8.95	8039	6.95
Z80A	4.95	9900JL	49.95	8073N	34.95
F8 (3850)	16.95	6502	4.95	8755	39.95
2850	16.95	6502	6.95	8748	39.95
1802	9.75	IM6100	29.95	8809	14.95
8080A	5.95	6800	10.95	6809E	19.95
8085	5.95	6800B	10.95	8086	29.95
				68000	49.95

## RAMS

6116/2016	\$7.95	2147	\$4.95	5290	\$1.99
8264-64K	5.95	411	5.99	5298	.49
4116-2	1.99	414	4.69	6508	4.50
4116-2	8/12.95	1101	.99	6518	6.79
2101	1.90	1103	.99	6561	3.79
2102	.79	4027	4.69	6604	3.99
21L02-2	1.49	4044	3.99	6605	7.99
21L02-4	.95	4050	4.69	9130	8.99
2111	2.45	4060	4.69	9140	8.99
2112	2.75	4096	3.99	93415	6.99
2114	1.49	4115	1.49	93425	6.99
2114-L-2	2.29	4200	7.95	5101	3.75
2114-L-4	1.99	4402	1.99	26132	24.95
2125	6.99	5280	4.60		

## SUPPORT

8155	\$7.95	8282	\$9.95	6875	\$5.75
8156	9.95	8283	9.95	6880	2.10
8202	24.95	8284	9.95	68047	22.95
8205	2.69	8286	9.95	68488	19.95
8212	2.10	8287	9.95	46505	14.95
8214	4.95	8288	29.00	6520	4.50
8216	1.75	8289	49.00	6522	7.95
8224	2.20	6810	2.95	6530-X	20.50
8226	2.95	6820	4.50	6532	9.95
8228	3.95	6821	4.50	6551	11.75
8243	5.95	6828	10.50	Z80-PIO	4.95
8250	14.95	6834	16.95	Z80A-PIO	5.50
8251	4.25	6845	14.95	Z80-CTC	4.40
8253	6.50	6847	14.95	Z80A-CTC	5.50
8255	4.50	6850	4.50	Z80-DMA	11.95
8257	7.50	6852	4.50	Z80-DMA	16.95
8259	6.95	6860	10.95	Z80-SIO	14.95
8275	29.95	6862	10.95	Z80A-SIO	16.95
8279	8.50				

## MOS PROMS

2764 (8Kx8) TS	\$9.95	2708 (450nS)	\$3.95
2732 (4Kx8) TS	6.95	68764 (8x8)	39.95
2532 (4Kx8) TS	8.95	27128 (16Kx8)	19.95
2716/2516, 5V (2Kx8) TS	4.95		
TM52716, 5V, 12V	17.95	MM5203AQ	14.50
2758, 5V, (450nS)	5.95	MM5204Q	9.95

## HI-TECH

2513-001 (SV) Upper	\$9.50	DAC08	\$9.95
2513-005 (SV) Lower	10.25	AD100	9.95
2513-ADMS (SV) Shifter	14.95	8038 Function Generator	4.50
MM66710 ASCII Shifted	12.95	MC4024 VCO	2.95
MM66740 Math Symbol	13.95	LM566 VCO	1.95
MM66750 Alpha Control	13.45	XR2206 Function Generator	5.25
17717 8 & 16 Millipip	5.95	TR16026 (SV, 12V)	3.95
1781 Dual Floppy	29.95	AV15103 (SV, 12V)	4.95
1791-01 Dual Floppy	36.95	AV15104/1612 (5-14V)	6.95
1791-02 Dual Floppy	44.95	AV15105/1863 (SV)	6.95
1793 DS Floppy	44.95	IM6402	7.95
1797 DS Floppy	54.95	IM6403	8.95
1891 Data Separator	18.95	2350 SRT	24.95
2143 Clock Generator	18.95	16718 Astros	24.95
8700 8 bit Binary	13.50	MC14411	11.95
8701 10 bit Binary	22.00	4702	14.95
8703 8 bit TS	13.50	WD1941	9.95
9400 Volt to Freq. Conv.	7.25	COM5016	16.95
8730 3 1/2 Digit BCD	13.95	IM8250	15.95
1408L6 6 bit	3.95	AV5-2376	13.75
1408L8 8 bit	5.95	AV5-3600	13.75
DAC01 D to A	5.95	MM5740AAC	8.95

## SOCKETS

				<b>LOW PROFILE SOCKETS (TIN)</b>
	1-24	24-49	50-100	
8 pin LP	.16	.15	.14	
14 pin LP	.20	.19	.18	
16 pin LP	.22	.21	.20	
18 pin LP	.29	.28	.27	
20 pin LP	.34	.32	.30	
22 pin LP	.29	.27	.24	
24 pin LP	.38	.37	.36	
28 pin LP	.45	.44	.43	
40 pin LP	.60	.59	.58	

	1-24	24-49	50-100
8 pin LP	.16	.15	.14
14 pin LP	.20	.19	.18

LINEAR			
78H05K	\$5.95	LM1414N	\$1.90
78M05	1.49	MC1458CN/N	.99
78M.0	1.49	MC1489N	.99
LM108AH	2.95	MC1489N	.99
LM300H	.99	LM1496M	.89
LM301CN	.35	LM1556N	1.50
LM301H	1.98	LM1820N	.95
LM305H	1.89	LM1850N	.95
LM306H	3.25	LM1889N	3.10
LM307CN	.29	LM2111N	1.75
LM308CN	.99	LM2900N	.99
LM309K	1.49	LM2901N	2.50
LM310CN	1.25	LM2913N	2.95
LM311D/CN	.89	CA3013T	2.19
LM312H	1.75	CA3018T	1.99
LM317T	1.70	CA3021T	3.49
LM318CN	1.49	CA3023T	2.99
LM319H/XX	1.25	CA3035T	2.75
LM320K-XX	1.35	CA3039T	1.29
LM320T-XX	1.39	CA3046N	1.29
LM320H-XX	1.25	LM3053N	1.49
LM323K	4.95	CA3059N	3.19
LM324N	.95	CA3060N	3.19
LM337K	1.25	CA3062N	4.95
LM338K	6.95	LM3065N	3.99
LM339N	.95	CA3080T	1.29
LM340K-XX	1.75	CA3081N	1.69
LM340T-XX	1.25	CA3082N	1.69
LM340H/XX	1.25	CA3083N	1.55
LM344H	1.95	CA3088N	.90
LM348N	1.29	CA3089N	2.99
LM350K	5.60	CA3096N	3.49
LM358CN	.98	CA3097N	1.99
LM360N	1.49	CA3130T	1.30
LM372N	1.95	CA3140T	1.19
LM376N	3.75	CA3146N	2.49
LM377N	2.75	CA3160T	1.19
LM380CN/N	1.25	CA3190N	1.95
LM381N	1.79	CA3410N	.59
LM383T	1.95	MC3423N	1.49
LM386N	1.25	MC3460N	3.95
LM387N	1.40	SG3524N	3.95
LM390N	1.95	CA3600N	3.59
NE531V/T	3.75	LM3900N	.59
NE555V	.39	LM3905N	1.19
NE566N	.98	LM3909N	.99
NE561T	19.95	LM3914N	3.75
NE566N/H	1.25	LM3915N	3.95
NE567V/H	1.75	LM3916N	3.75
NE569N	1.50	RC4131N	2.95
LM702H	2.75	RC4136N	1.10
LM709N/H	.29	RC4151N	3.70
LM710N/H	.75	RC4194TK	4.95
LM711N/H	.39	RC4195TK	5.40
LM715N	1.95	ULN2003	1.25
LM723N/H	.65	SN75450N	.59
LM733N/H	.98	SN75451N	.35
LM739N	1.15	SN75452N	.49
LM741CN/H	.33	SN75453N	.49
LM741CN-14	.19	SN75454N	.49
LM747N/H	.75	SN75491N	.89
LM749N/H	.39	SN75492N	.89
LM760CN	2.95	SN75493N	.89
LM761CN	1.90	SN75494N	.89
MC1330	1.95	TL494CN	4.20
MC1350	1.95	TL496CP	1.65
MC1358	1.75		

## 74S00

74S00	\$ .39	74S124	\$3 .69	74S244	\$2 .99
74S02	.43	74S133	.54	74S251	1.35
74S03	.45	74S134	.66	74S253	1.35
74S04	.89	74S137	1.15	74S257	1.29
74S05	.52	74S138	1.69	74S258	1.29
74S08	.49	74S139	1.89	74S260	2.79
74S09	.49	74S139	1.29	74S280	2.79
74S10	.42	74S140	.73	74S287	.99
74S11	.42	74S151	1.29	74S288	2.55
74S12	.42	74S153	1.29	74S273	3.10
74S20	.42	74S157	1.29	74S374	3.10
74S22	.42	74S158	1.29	74S387	2.75
74S30	.42	74S160	.79	74S388	2.75
74S32	.49	74S174	1.49	74S472	.95
74S38	1.19	74S175	1.49	74S473	7.95
74S40	.49	74S188	2.69	74S474	9.95
74S42	.42	74S194	1.89	74S475	9.95
74S44	.46	74S195	1.89	74S476	9.95
74S46	.46	74S196	1.89	74S571	5.75
74S57	.99	74S240	2.75	74S572	8.95
74S86	.72	74S241	2.75	74S573	8.95
74S87	.72	74S242	2.99	74S574	8.95
74S113	.72	74S243	.99	74S94	2.90
74S114	.72				



## 0-35dB GAIN VARIABLE RF AMPLIFIER

Works with All RF Signals from 40-900 MHz



### EXCELLENT FOR:

- All Antenna Systems
- Voice Communications
- Video RF Line Amplifiers
- Frequency Counters
- MATV Systems
- CCTV Systems
- Oscilloscopes
- FM Broadcasts

Now you can use one TV/FM Antenna to cover all close and distant stations without experiencing overloading problems. Ideal for outdoor and indoor use. I/O impedance is 75 ohms. Power Supply is separate coax feed system which allows amplifier to be located anywhere in cable run. Power Supply has knob to control variable gain, LED power on indicator, built-in AB switch and on/off switch.

ALL-2VG Wired and Tested ..... **\$49<sup>95</sup>**

Take advantage of our recently purchased manufacturing and patent rights to the ALL-2VG

## MODULATOR

### Not A Game Type Modulator

The MPS-1 Kit converts Video/Audio signals to a crystal controlled RF output for TV Channels 3 and 4. The MPS-1 Modulator's ad justable inputs are designed to match all TV Cameras and VCRs and features a voltage regulated power supply, power switch and LED indicator. No Tuning Required. Operates on 117VAC. MPS-1 Modulator Kit .....

**\$29<sup>95</sup>**

## VIDEO GUARD

5030 Paradise, Suite C-100, Las Vegas, NV 89119

Telephone: 702-739-9732/9733

MAIL ORDERS: Send check or money orders. Add 5% shipping and handling, minimum \$1.50. Write for more details free.

CIRCLE 9 ON FREE INFORMATION CARD

## ELECTRONIC KITS FROM HAL-TRONIX

2304 MHZ DOWN CONVERTERS. TUNES IN ON CHANNELS 2 TO 7 ON YOUR OWN HOME T.V. HAS FREQUENCY RANGE FROM 2000 MHZ TO 2500 MHZ. EASY TO CONSTRUCT AND COMES COMPLETE WITH ALL PARTS INCLUDING A DIE-CAST ALUM CASE AND COAX FITTINGS. REQUIRE A VARIABLE POWER SUPPLY AND ANTENNA (Antenna can be a dish type or coffee can type depending on the signal strength in your area.)

2304 MOD 1 (Basic Kit) ..... \$19.95  
(Less case & fittings)

2304 MOD 2 (Basic/Pre-amp) ..... \$29.95  
(Less case & fittings)

2304 MOD 3 (Hi-Gain Pre-amp) ..... \$39.95  
(Includes case & fittings)

POWER SUPPLY FOR EITHER MODEL ABOVE IS AVAILABLE. COMES COMPLETE WITH ALL PARTS, CASE, TRANSFORMER, ANTENNA SWITCH AND CONNECTORS (Kit) \$24.95

Assembled..... \$34.95

Slotted Microwave Antenna For Above

Downverters..... \$39.95

### PREAMPLIFIERS

HAL PA-19—1.5 mhz to 150 mhz. 19db gain operates on 8 to 18 volts at 10ma. Complete unit \$8.95.

HAL PA-14—3 mhz to 1.4 ghz. 10 to 12 db gain operates on 8 to 18 volts at 10 ma. Complete unit \$12.95.

(The above units are ideal for receivers, counters, etc.)

16 LINE TOUCH TONE DECODE KIT WITH P.C. BOARD AND PARTS..... \$69.95

12 LINE TOUCH TONE DECODE KIT WITH P.C. BOARD AND PARTS..... \$39.95

16 LINE ENCODER KIT, COMPLETE WITH CASE, PAD AND COMPONENTS..... \$39.95

12 LINE ENCODER KIT, COMPLETE WITH CASE, PAD AND COMPONENTS..... \$29.95

Complete Sets of P.C. Boards Available For: Unicorn

Robot Project and Heart-A-Matic Project.

MANY, MANY OTHER KITS AVAILABLE

Send 20 cents stamp or S.A.S.E. for information and flyer on other

HAL-TRONIX products. To order by phone: 1-315-285-1782.



### HAL-TRONIX

P.O. Box 1101

Southgate, MI 48195

SHIPPING INFORMATION:

ORDERS OVER \$25.00 WILL BE SHIPPED POSTPAID EXCEPT ON ITEMS WHERE ADDITIONAL CHARGES ARE REQUESTED. ON ORDERS LESS THAN \$25.00 PLEASE INCLUDE ADDITIONAL \$2.00 FOR HANDLING AND MAILING CHARGES.

CIRCLE 75 ON FREE INFORMATION CARD

## AMAZING DEVICES

**PHASOR PAIN FIELD** — Patented and recently developed in our labs is being tested by Gov't for riot control. Soon to come under weapons restrictions as an infernal machine. Easily hand-held. Hazardous if NOT USED WITH DISCRETION.

PPF-1 PLANS (sold for animal control)..... **\$15.00**

**INVISIBLE PAIN FIELD GENERATOR** — Produces a directional field of moderately intense pain to back of head up to 50'. Cigarette pack size enclosure is easily hidden.

IPG-3 PLANS ..... **\$7.00** IPG-3K KIT & PLANS ..... **\$44.50**

IPG-30 (assembled for animal control)..... **\$59.50**

**PHASOR STUN/BURNING WAND** — Produces sufficient electrical energy capable of burning flesh. Intended as a personal defense device.

PSW-3 PLANS ..... **\$8.00** PSW-3K KIT & PLANS ..... **\$59.50**

**RUBY LASER RAY PISTOL** — Intense visible red, burns, hazardous, with parts sources.

RUBY PLANS (includes all part sources)..... **\$15.00**

**CARBON DIOXIDE LASER** — Generates 20-40 watts of continuous power capable of burning, cutting, hazardous. (with all part sources)..... **\$15.00**

**LASER RIFLE** — Produces 200-3000 pulses of 30 watt optical energy. Portable and easily hand-held.

LRG-3 PLANS ..... **\$10.00**

LRG-3K KIT PLANS (minus diode)..... **\$129.50**

**POCKET LASER** — For the beginner, visible red "optical version", non-hazardous.

LHC-2 ..... **\$5.00** LHC-2K KIT & PLANS ..... **\$24.50**

**HIGH POWERED PORTABLE ENERGY SOURCE FOR LASERS AND MAGNETIC WEAPONS** — Exploding wires, shockwave, etc. Miniature size.

HPS-1 PLANS ..... **\$8.00** HPS-1K KIT & PLANS ..... **\$49.50**

**PARTICLE BEAM WEAPON** — PLANS ..... **\$15.00**

**INFINITY XMTR** — Uses telephone lines for selective home or office listening while away on business or vacation.

INF-1 PLANS ..... **\$15.00**

**SEE IN DARK** — Long range, total darkness.

SD-4 PLANS ..... **\$10.00**

**LONG RANGE WIRELESS MIKE** — Crystal clear quality — miniature.

FBT-7 PLANS ..... **\$7.00** FBT-7K PLANS & KIT ..... **\$34.50**

**WIRELESS TELEPHONE TRANSMITTER** — Long range, automatic.

VWPM-5 PLANS ..... **\$10.00** VWPM-5K PLANS & KIT ..... **\$34.50**

Send for **FREE** catalog description of above plus hundreds more plans, kits and completed items. We accept MC or Visa or when ordering, send check or money order. We pay shipping charges on orders over \$50.00, otherwise include 10% with remittance.

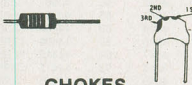
SEND TO: **SCIENTIFIC SYSTEMS**

DEPT. R8, BOX 716, AMHERST, N.H. 03031

CIRCLE 109 ON FREE INFORMATION CARD

### POPULAR CHIPS

LM 301	.49
LM 380	1.29
LM 386	.89
LM 565	1.00
MC 1330	1.25
MC 1350	1.15
MC 1358	1.25
MC 1458	.49
MC 1496	1.50
LM 1889	2.50
7805	.80
7808	.80
7812	.80
7815	.80
7818	.80
MV 2109	.69
2N2222	.30
MC1349	1.79

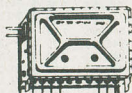


### CHOKES

.33 uh	33 uh
.47 uh	100 uh
15 uh	10 mh
18 uh	69¢ each

### VARI CAPS

10 - 60 pf	79¢ each
30 - 90 pf	79¢ each



**MITSUMI**  
UES A55F  
**VARACTOR TUNER**  
CHAN. 14-83  
300 ohm INPUT **\$17.95**

### DELUXE PARTS ASSORTMENTS

**#1 Resistors & Trimpots**  
68 1/4 watt, 5% resistors & 5 PT-15 10K trimpots. 1 each - 51, 75, 100, 470, 1.5K, 3.6K, 51K, 470K, 13-1.2K, 2-220, 3-100K, 6-330, 6-12K, 7-910, 9-3.3K, & 14-4.7K.  
**\$5.25 each**

**#2 Capacitor "A"**  
Monolithic - 1-560pf, 7-1 mfd, & 1-22 mfd. Silver Micas - 2-10pf, & 1 each of 43pf, 110pf, 560pf, 1200pf, 3000 or 3300pf.  
**\$5.95 each.**

**#3 Capacitor "B"**  
Mylars 4-.001, 2-.047, 29-.01. Radial electrolytics 3-10 mfd 16V, 1-1000 mfd 50V, 1-2200 mfd 35V. Disc Caps 1 each of 5, 12, 27, 36, 110, 330pf, 2-120pf, 3-39pf, 3-220pf, and 1 Vari Cap 5-35pf.  
**\$7.50 each**

**UHF AMP KIT**  
25 db gain  
stripline PC board  
using  
(2) BFR-90's  
**\$10.95**  
power supply  
for above **\$3.49**

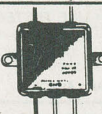
**MINI FAN 3.125" SQ.**  
40 CMF  
115VAC-60hz  
REMOVED FROM  
NEW EQUIP.  
TESTED **\$6.95**



## NETWORK SALES, INC.

### RFI FILTER

RFI suppression of fluorescent lights, machines, and appliances. Cornell-Dubilier #1F-54 100/220 VAC/DC. 2 amps. **\$4.95 ea.**



### TIMEX® SINCLAIR® CONNECTOR

Dual 43 pin. 0.1" spacing  
Wire wrap—gold plated **4.95 ea.**

### VERNIER PANEL POTS

Multi-turn. 1/4" shaft.  
500 ohm, 1K, or 10K.  
**\$4.49**

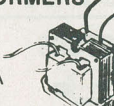


### BYPASS CAP SPECIAL

.1 MFD — 50vDC  
**100/\$5<sup>00</sup>**

### POWER TRANSFORMERS

Pri: 115V AC  
Sec: 24 volts @ .350 A  
Dim: 2 1/4 x 1 x 1 H



**\$1.95 ea. 10/\$15.00 100/\$125.00**

### THUMBWHEEL TRIMMER POTS

**VERTICAL MOUNT**  
OHMS 500, 1K, 2K, 5K, 10K, 25K  
50K, 100K, 200K, 500K, 1 MEG.  
4/\$1.00 100/\$20.00

### MINI COAX CABLE

RG-174 50ohm .100 OD  
**10 feet/\$1.00**

### SOLID CARBIDE PC DRILL

#55 1/8 in. SHANK FOR  
USE WITH DREMEL TOOL  
**Special 79¢ ea 10/\$5<sup>00</sup>**

### DIP SWITCHES

High quality DIP switches mfg. by CTS. Available in the following configurations.

4 POS—80¢ 6 POS—80¢  
5 POS—80¢ 7 POS—80¢



### DB-25 S (FEMALE)

The most popular computer connector. Mfg. by AMP. .025" gold PC pins with mfg. holes.  
**\$1.95**



### BRIDGE RECTIFIERS

35A	200 PIV	\$2.00
25A	100 PIV	\$1.50
3A	400 PIV	\$1.00



### THUMBWHEEL SWITCH

**\$7.95** BCD 0-9

W/COMPLIMENT

(EACH DIGIT ILLUMINATED W/LED)

4 DIGIT

W/END PLATES FOR EASY MTG.



### 4 TURN TRIM POTS

**BOURNS #3339B**

1K — 6K R/A — 10K

**Special 99¢ ea.**



### RF COIL

Same as #49A537MPC

**\$1.50 ea. 10/\$12.50**



CIRCLE 90 ON FREE INFORMATION CARD



# BETA Electronics

1700 E. DESERT INN RD., SUITE 222 LAS VEGAS, NEV. 89109

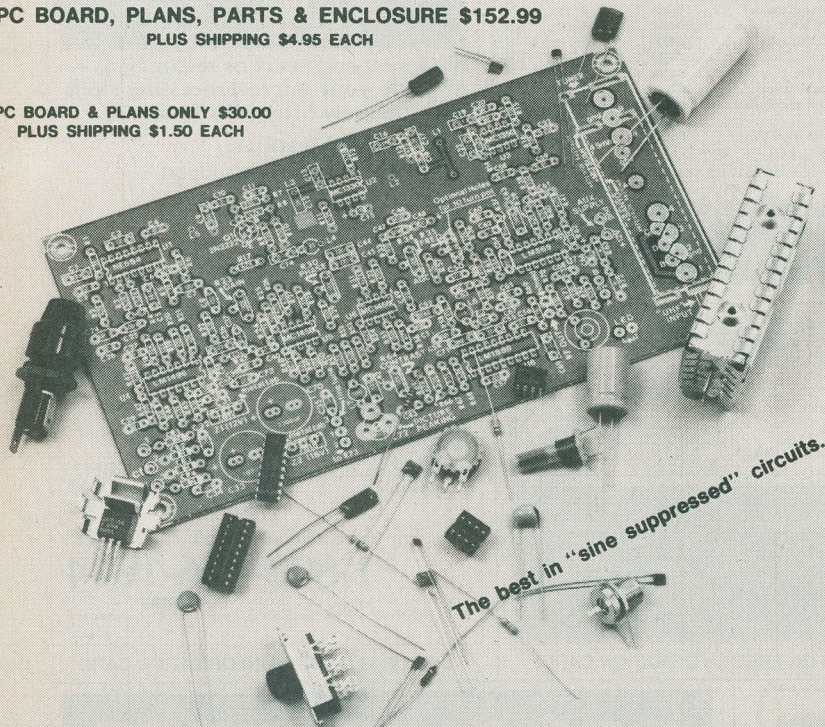
TOLL FREE 800 - 782-2701

"LEADER IN THE BEST  
VIDEO CIRCUITS FOR THE  
EXPERIMENTERS."

## "The Deluxe II"

PC BOARD, PLANS, PARTS & ENCLOSURE \$152.99  
PLUS SHIPPING \$4.95 EACH

PC BOARD & PLANS ONLY \$30.00  
PLUS SHIPPING \$1.50 EACH



The best in "sine suppressed" circuits.

The ultimate in UHF sine wave converter technology with modulated audio.  
Easy to build with fully illustrated plans. Outstanding video clarity and stability.

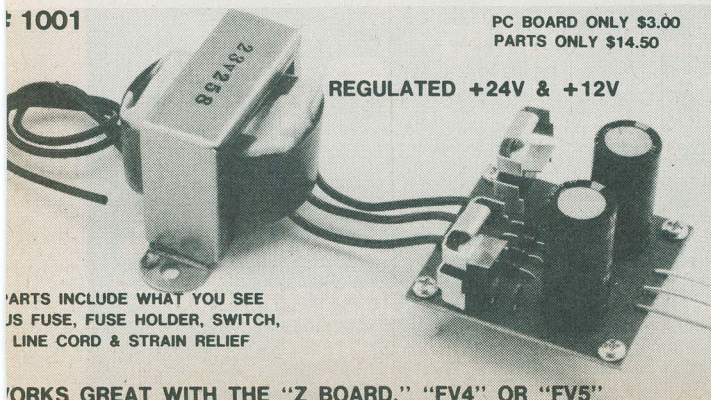
## UHF AMPLIFIER KIT

PC BOARD, PLANS & PARTS \$19.99  
PLUS SHIPPING \$1.50 EACH

EASY TO BUILD & NO SPECIAL EQUIPMENT REQUIRED.  
IMPROVES RECEPTION WITH 12db GAIN.

## DUAL POWER SUPPLY

PC BOARD, PLANS & PARTS \$17.50  
PLUS SHIPPING \$2.50 EACH



PC BOARD ONLY \$3.00  
PARTS ONLY \$14.50

REGULATED +24V & +12V

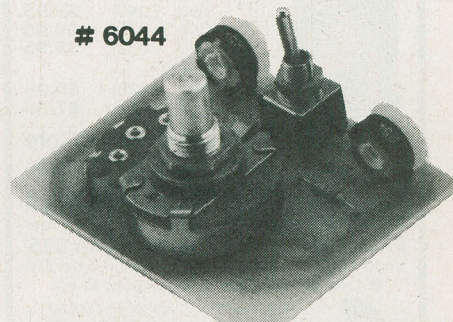
PARTS INCLUDE WHAT YOU SEE  
JS FUSE, FUSE HOLDER, SWITCH,  
LINE CORD & STRAIN RELIEF

WORKS GREAT WITH THE "Z BOARD," "FV4" OR "FV5"

## TWO CHANNEL SELECTOR SWITCH

PC BOARD, PLANS & PARTS \$5.95  
PLUS SHIPPING \$1.50 EACH

# 6044



FITS DIRECTLY INTO YOUR DELUXE II  
FOR CONVENIENT CHANNEL SELECTION.

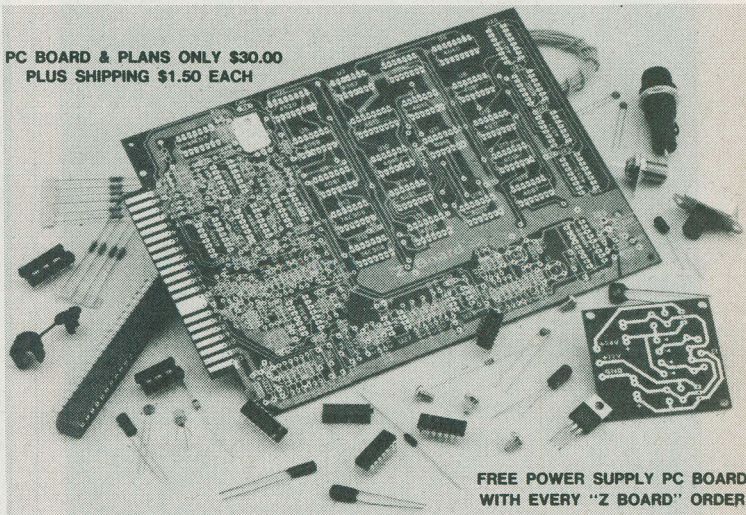
SPECIAL

NE 564 SUBSTITUTE CIRCUITS AVAILABLE  
(PLUGS DIRECTLY INTO THE NE 564 POSITION)  
\$4.95 EACH PLUS \$1.50 SHIPPING.

## "THE Z BOARD"

PC BOARD, PLANS, PARTS & ENCLOSURE \$119.95  
PLUS SHIPPING \$4.95 EACH

PC BOARD & PLANS ONLY \$30.00  
PLUS SHIPPING \$1.50 EACH



FREE POWER SUPPLY PC BOARD  
WITH EVERY "Z BOARD" ORDER

A powerful circuit with a challenge.  
The best in UHF "pulse suppressed" circuits.  
Suppressed horizontal synchronization with video inversion and  
modulated audio that mates with your Zenith M1 module.  
Fully illustrated plans for easy assembly.

QUANTITY DISCOUNTS AVAILABLE

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CALIF. ORDERS ADD 6% SALES TAX

VISA/MST MONEY ORDERS NO PERSONAL CHECKS



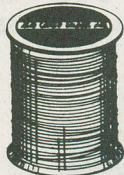
# FINEST QUALITY

Government Approved QQ-S-571e

# SOLDER

**SPECIAL  
FOR THE MONTH**

SN 60/40 Rosin Core (RA)



One lb. Reels		
16	swg. (.064)	\$7.95
18	swg. (.048)	\$8.45
19	swg. (.040)	\$8.95
20	swg. (.036)	\$9.45
21	swg. (.032)	\$9.95
1/2 lb. Reels		
22	swg. (.028)	\$5.95
24	swg. (.022)	\$7.95

SN 62 (2% Silver) Eutectic-Rosin Core  
21 swg. (.031) \$19.95

**Plus FREE Desoldering Wick**  
with each pound of solder

**FREE Freight On All Orders Over \$25**  
Under \$25 add \$2.50 per order. Minimum order \$10

■ Check ■ Money Order ■ Master Charge ■ Visa

N.Y. State residents add appropriate sales tax.

**To place your order call:**  
**TOLL FREE 800-645-4808**

In NYS (516) 334-2660 No COD's accepted

**SolderCraft™**  
P.O. Box 668 Jericho, N.Y. 11753

CIRCLE 58 ON FREE INFORMATION CARD

**FREE  
GIANT  
CATALOG**

Send for our FREE 1984 catalog of electronic components, kits, IC's, computer software, computer peripherals and unique items.

**PARTS SUPER SPECIALS!**

**12VDC BRIGHT GREEN  
FLUORESCENT CAR CLOCK**

Complete 12VDC car clock in case features bright green display and ignition blanking. Size: 3" x 4.50 C5002 \$4.50

**CARBIDE ROUTER BIT**

Sharpest, hardest router bit for routing pc boards. 1/8" shank. Bits are approx. No. 42 dia and 1/8" cutting length. C4958 \$1.79

9V 30MA Solar Panel	C5006	\$12.00
2 1/4" 25 ohm Round Speaker	C5001	\$1.25
Box of Caps (at least 250 pieces)	C4810	\$5.00
TIL 122/TIP 122 Transistor	C6003	79¢ each
40 pin IC Socket	C4781	5/\$1.00
6" Nylon Cable Ties	C6004	10/\$1.00
3.579545MHZ Color Crystal	C4035	99¢ each
Miniature CDS Cell 20 MEG/500 ohm	C4818	2/\$1.00
Green Glow Neons	C4451	8/\$2.00
2x3" Zip Bags with White Block	C6005	50/\$2.50

Carbide Drill Bits #55, 56, 58  
59, 61, 63 Your Choice... 1.29 ea.

**VISIT OUR NEW RETAIL STORE**

LOCATED AT 3101 W. HAMPDEN, ENGLEWOOD, CO 80110

Phone 781-1589

**PAC TEC ELECTRONIC ENCLOSURE**

Professional looking case is great for instruments and projects. Black textured plastic finish with removable end panels. Size: 8" W x 6 1/4" D x 2 1/2" H. C6006 \$8.95

**FASCINATION STAR KIT**

Produces an "exploding star" visual effect using 2s LEDs and IC circuitry. Kit with all parts and pc board. Synthesizer for 20". C4432 \$10.95

**3 CHANNEL COLOR ORGAN KIT**

Handles up to 200W per channel and up to 35W input. Complete with all parts and pc board. C4530 \$9.50

**NEGATIVE ION GENERATOR BOARD**

Brand new circuit board emits negative ions that remove smoke particles, dust, etc. from air. Only 3" square. Requires 12V to 12VDC for operation. C6002 \$14.95

**CHANEY electronics inc.**

P.O. BOX 27038  
DENVER, COLORADO 80227  
303-781-5750

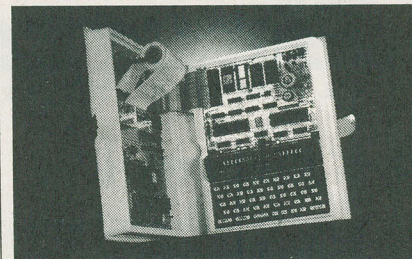
Phone Orders 303-781-5750

- Minimum AD Order \$9.00
- Please include \$2.00 for postage (UPS)
- VISA MC accepted
- Phone orders are welcome

Send for our free catalog of unique items

CIRCLE 34 ON FREE INFORMATION CARD

## Learn micro-processing with the new MICRO-PROFESSOR 1P



Students, engineers or technicians—  
upgrade your micro-processing skills  
with the new Micro-Professor 1P.

The MPF-1P features:

- extensive software support
- more built-in memory
- improved keyboard
- larger display

Three tutorial guides help cover all capabilities. The ideal training tool! MPF-1P will deliver you into the growing world of micro-processing. Invest now!

**Plus—FREE GIFT Only \$179.95**

□ Check this box for FREE Z-80 Microprocessor Programming and Interfacing textbook when you order within 7 days. \$12.95 value.

**ETRONIX**  
Dept. RE123  
14803 N.E. 40th  
Redmond, WA 98052

For immediate action call TOLL FREE:

**1-800-426-1044**

Full money back guarantee.

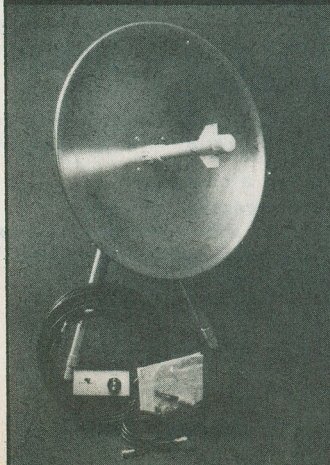
CIRCLE 39 ON FREE INFORMATION CARD

## MICROWAVE TV ANTENNA SYSTEMS

Freq. 2.1 to 2.6 GHz • 34 db Gain +



**TWO YEAR WARRANTY  
PARTS & LABOR**



**COMPLETE SYSTEMS  
(as Pictured)**

Commercial 40" Rod Style \$ 89.95  
Parabolic 20" Dish Style \$ 79.95

**COMPONENTS**  
Down Converters (both types) \$ 34.95  
Power Supplies (12V to 16V) \$ 24.95

Data Info (Plans) \$ 9.95  
CALL OR WRITE FOR KITS, PARTS, INDIVIDUAL COMPONENTS

**Phillips-Tech Electronics**  
P.O. Box 34772  
Phoenix, AZ 85067  
(602) 265-8255

**We Repair All Types Down Converters & Power Supplies**

**Special Quantity Pricing  
Dealers Wanted**

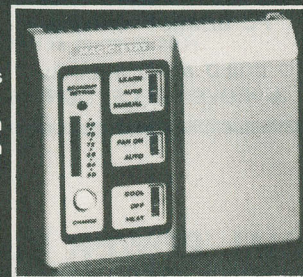


CIRCLE 29 ON FREE INFORMATION CARD

## COMPUTERIZED THERMOSTAT

**FULLY PROGRAMMABLE • GUARANTEED TO  
REDUCE YOUR HEATING-COOLING BILLS 30-50%!!**

- For Home or Office
- Patented Microprocessor
- Up to 6 settings a day, 7 days per week
- Simple one-button operation
- Simple 10 minute installation for do-it-yourselfer
- Qualifies for 15% Energy Tax Credit
- Warranty



Dimensions 5 3/8 W x 4 1/2 H x 1 3/16 D  
24 V Systems • Not for 2 Stage Heat Pumps

**COMPLETE UNIT \$79.95**

**KIT FORM \$64.95**

**INCL. \$2.50 FOR SHIPPING**



**EXCLUSIVE 3-WAY GUARANTEE** 1. 30-day money-back, no hassle guarantee. 2. One year money-back performance guarantee. If you don't save at least the cost of the unit in a year. MAGIC-STAT will give you a full refund. 3. Three-year warranty on parts and workmanship. Full details with each MAGIC-STAT. (Guarantees apply to complete units only)



**KCS ELECTRONICS CORPORATION**

P.O. BOX 33205  
PHOENIX, AZ 85015 **(602) 274-2885**

**Call or write for FREE  
Semiconductor Parts & Products Catalog**

CIRCLE 83 ON FREE INFORMATION CARD

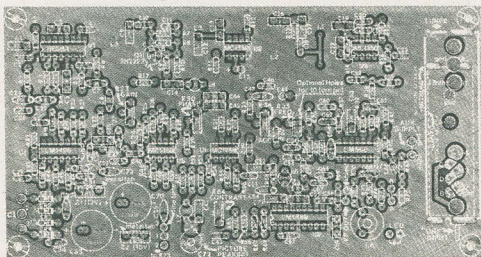




# POPULAR TELEVISION CIRCUITS

## SINE WAVE SUPER BOARD

- ☐ KSW 1483 Sinewave Kit \$119.95 + \$5.95 S/H
- ☐ KSO 1484 Sinewave Minus PCB \$99.95 + \$5.95 S/H
- ☐ PCS 6252 Sinewave PCB only \$20.00 + \$3.00 S/H



State of the art technology brings you this superior Sinewave Superboard. It has no internal connection to TV, RF modulator built on the board, AGC for stability and tunes the entire band with a varactor tuner and multi-turn pot. A high quality plated-thru circuit board with silk-screened parts layout, easy to follow, fully illustrated instructions and quality parts make this kit easy to assemble. The beautifully finished cabinet will add a touch of class to the many hours of enjoyment you will receive building and using this kit.

### MISCELLANEOUS

- ☐ SHC 0010 Satellite Hook-up Cable Kit \$59.95 + \$5.95 S/H
- ☐ VCP 1283 Video Color Processor **CALL FOR PRICE**
- ☐ STC 1283 Selectric Typewriter Converter

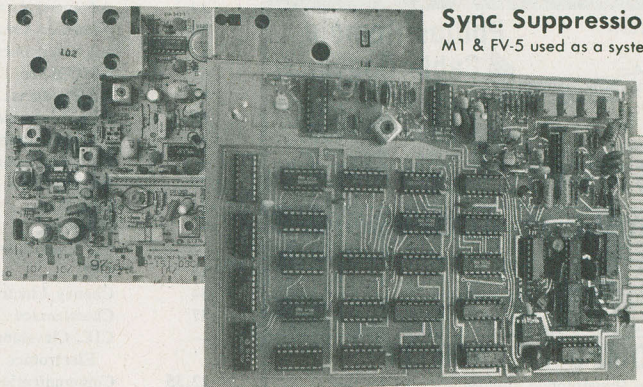


## ZENITH M1 FV-5

09-151-03

Phase Video

**Sync. Suppression**  
M1 & FV-5 used as a system



- ☐ KZM 2083 M1 FV-5 Kit \$199.95 + \$6.95 S/H
- ☐ PCZ 8000 FV-5 PCB only \$30.00 + \$3.00 S/H
- ☐ KZO 2084 FV-5 Kit (minus M1) \$149.95 + \$6.95 S/H
- ☐ ZMO 9151 M1 Board only \$89.95 + \$5.95 S/H

This advanced baseband video inversion/sync suppression system which is most often used nationwide is one of our most popular kits. It features AGC for stability, RF modulator built on the board, no internal connection to T.V. and full band variable tuning. High quality parts, fully illustrated instructions, pre-punched cabinet and plated-thru/solder-masked P.C. board make this kit a breeze to assemble. The M1 varactor tuner board is assembled and tested and need only be interconnected to the FV-5 board. The completed circuitry is then placed in the beautifully finished cabinet. Place your order today.

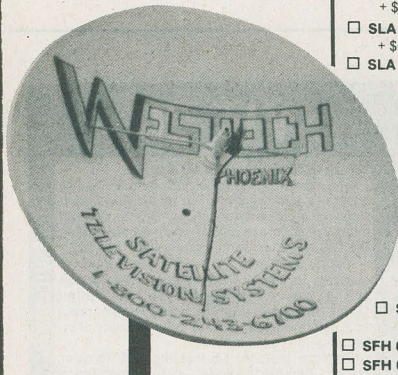
# SATELLITE TELEVISION



## DISHES

- ☐ SFD 6000 Satellite Dish 6' \$349.95 25-H FOB
- ☐ SFD 8000 Satellite Dish 8' \$449.95 30-H FOB

- \* Fiberglass with Integral Mount Surface
- \* Sturdy Polar Mount with Jack
- \* Feed Mount Assembly for Easy Focal Alignment



### MISCELLANEOUS

- ☐ CSP 0002 Calendar \$5.95
- ☐ SHC 0010 Satellite Hook-up Cable Kit \$59.95

## Low Noise Amplifiers



- ☐ SLA 1200 LNA 120 K \$349.95 + \$6.00 S/H
- ☐ SLA 1100 LNA 110 K \$394.95 + \$6.00 S/H
- ☐ SLA 1000 LNA 100 K \$489.95 + \$6.00 S/H
- ☐ SLA 0900 LNA 90 K \$664.95 + \$6.00 S/H

## FEED HORNS



- ☐ SFH 0300 D.C. Motor Feed \$144.95 + \$4.95 S/H
- ☐ SFH 0100 Single Feed \$17.95 + \$4.95 S/H
- ☐ SFH 0200 Dual Feed \$144.95 + \$4.95 S/H
- ☐ SFH 0400 Servo Feed \$179.95 + \$4.95 S/H

### What do you need for a complete Satellite System?

A basic system consists of a mounting pole (preferably set in concrete), a polar mount, a receiver dish, a feed assembly, a feed horn with polarity rotor, a low noise amplifier (LNA), a receiver with down converter and modulator, and cables to interconnect these components from the dish to your TV set.

## RECEIVERS

*Miste*

- ☐ SRM 2000 Satellite RCVR

Miste \$349.95 + \$8.95 S/H



- \* Signal Strength Carrier Level Meter
- \* Crystal Controlled Video Modulator
- \* Detent Channel Tuning with Fine Tune
- \* Scan Mode on Front
- \* Polarity Selector on Front
- \* Decoder Output—5 Pin DIN
- \* Antenna Mounted Image Reject Mixer (Down Converter)

## OMNI

- ☐ STO 2500 Satellite RCVR

\$449.95 + \$8.95 S/H

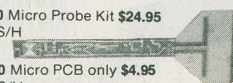


### FEATURES

- \* Signal Strength Carrier Level Meter
- \* Crystal Controlled Video Modulator
- \* Detent Channel Tuning with Fine Tune
- \* Scan Mode on Front
- \* Polarity Selector on Front
- \* Decoder Output—5 Pin DIN
- \* Block Down Converter (Mounts on LNA)

## MICROWAVE PROBE

- ☐ KMP 2030 Micro Probe Kit \$24.95 + \$3.00 S/H
- ☐ PCM 2000 Micro PCB only \$4.95 + \$3.00 S/H



20" PARABOLIC ALUMINUM DISH

- ☐ MPD 2000 Micro 20" Dish

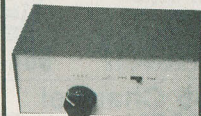
\$14.95

+ \$5.95 S/H



The new **SKY RANGER** wide band microwave receiver system will receive signals in the 1.9 GHz to 2.9 GHz range (including ham band, religious and educational channels). This is an assembled unit. Everything is included except the mounting pole and the TV set. **ALL THIS for only \$69.95.** Quantity discounts available. Take advantage of this exciting offer **TODAY!!**

## POWER SUPPLY KIT



- ☐ KMP 1218 Micro Power Supply Kit \$19.95 + \$3.00 S/H

## RF MODULATORS

**BRAND NEW!**



- ☐ RFM 3040 Crystal Modulators \$24.95 + \$3.00 S/H

- \* Crystal Controlled
- \* Brilliant Picture on Ch. 3 or 4
- \* For Video Tape Recorders, Satellite TV Receivers

- \* HOBBY USE ONLY, NOT FOR UNAUTHORIZED RECEPTION OF TV SIGNALS.
- \* AVAILABLE BY MAIL ONLY.
- \* COMPLETE REPAIR SERVICE.
- \* SEND FOR INFORMATION ON OTHER ITEMS.
- \* CHECKS HELD 3 WEEKS FOR CLEARANCE.

4218 S. 36TH PL., PHOENIX, ARIZONA 85040

ORDERS ONLY:

**(800) 243-6700**



**WESTECH**  
**WESTECH ELECTRONICS**  
**(602) 276-1600**

DECEMBER 1983



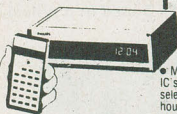
# SPARTAN Electronics Inc.



CALL (516) 499-9500 MAIL

6094 Jericho Tpke.  
Commack, N.Y. 11725

CTC9R



## Philips Remote Cable Converter

\$139.95

• Micro computer technology • Quartz controlled IC's lock in picture & prevent drift • 60 channel selections • Programmable time on & off • 24 hour LED digital clock • Favorite channel memory & recall plus scan • Wireless hand held infra-red transmitter system • Automatic fine tune • Adaptable to any brand television • One year warranty service.

## CABLE TV ACCESSORIES

2 set coupler	2.95
Coax Cable 100'	9.95
4 set coupler	4.50
F Connectors	.25
Matching transformer	.99
TV Game Switch	3.95
VHF-UHF AMP-28DB	29.95
Crimp Tool for F Conn	8.95

## COMPUTER CARE KIT

The Preventative maintenance kit for the office and home computer

Contains: Precision Duster, Zero Charge Anti-Static Screen and Keyboard cleaner Zero Charge Anti-Stat.



## SGL WABER \$35.95

Protect your computer and electronic equipment from voltage spikes

DG115P

DG115S

(6 Outlet)

\$45.95



## WINEGARD FM CAR ANTENNA BOOSTER

Amplifies FM radio signals an average of 18dB (8 times). Improves car radio reception and extends range to allow greater selection of stations. Switch and indicator light attaches to lower edge of dash. 24" cable with Motorola plugs provided. Installs in minutes. Great for window antennas.

\$26.95

## REFURBISHED MONITORS

9", 12", Commercial Grade as low as

\$39.95



## 10KM Cordless Telephone

Model 5500M (modified)  
\$325.00  
External Antenna required  
For export use only



## BECKMAN CIRCUITMATE 20

8 functions and 30 ranges - Diode/transistor test function - auto-polarity, auto-zero, and auto-decimal - 10 Amps AC and DC Current Capability - Transistor Gain Test (hFE) - Conductance



\$64.95

## Jerrold 36 Channel Remote CATV Converter

w/on/off Fine Tuning \$94.95  
58 Channel Wireless \$109.95



## 40 Channel VHF to UHF Block Converter

28.95 Ea.  
24.95 4 & up



Deluxe Version - Features fine tuning knob, matching X former & 2 cables \$38.95

## Volume Discounts

Min. Order \$25.00			
International Shipping Add'l	to 75.00	\$2.50	
Prices subject to change without notice	76.00 to 250.00	\$4.50	
COD 2.00 Extra	251.00 to 500.00	\$6.00	
*Add'l shipping for monitors	501.00 to 750.00	\$8.50	
	751.00 to 1000.00	\$12.00	
	Over 1000.00	\$12.50	

(516) 499-9500 Mon Th 9-8 Tu W F 9-6 Sa 9:30-5

## ADVERTISING INDEX

RADIO-ELECTRONICS does not assume any responsibility for errors that may appear in the index below.

### Free Information Number

	Page
92 Action Electronics	108
3 Active Electronics	134
— Advance Electronics	42, 43, 47
19 Advanced Analog Systems	108
80 Advanced Computer Products	135
12 All Electronics	123
67 AMC Sales	106
87 AP Products	Cover 3
60 BBC Metrawatt	9
10 Beckman Instruments	89-92
— Beta Electronics	137
77 BK Precision Dynascan	39
5 Byte-Ryte	1
7 Calvert	23
— CD Electronics	104
18 CEI	30
34 Chaney Electronics	138
37 Chemtronics	44
— CIE, Cleveland Institute of Electronics	52-55
22,35 Communications Electronics	2, 12, 13
88 Components Express	121
68 Computer Products	
— Peripherals	122
24 Contact East	109
86 Cooper Tools	Cover 2
84 CRT Factory	108
— Daetron	101
95 Diamondback Electronics	124
65 Digi-Key	126, 127
11 Digitron	122
53 Direct Video Sales	110
99 Dokay Computer Products	128, 129
54 DTI	103
74 Electra Company	21
26 Electro Industries	104
59 Electronic Rainbow	28
6 Electronic Specialists	118
33 Electronic Warehouse	41
— Electronics Book Club	32, 46
42 Enterprise Development	110
50 ETCO	153
39 Etronix	138
40 Firestick Antenna	106
— Fordham Radio	96, 105
76 Formula International	119
21 Gamit Appliance Service	108
98 Gamma Electronics	134
— Gilco International	122
71,75 Gladstone Electronics	97, 102
96 Global Specialists	94
— Grantham College of Engineering	31
75 Hal-tronix	136
38, 4, 15, 20 Heath	71-73, 97, 99, 101, 103
85 Hickok Electrical Instruments	102
94 Illinois Audio	104
— ISCET	110
41 Jameco Electronics	116, 117
28 Jan Crystal	106
49 JDR Microdevices	130-133
72 John Fluke MFG. Co. INC.	6, 7
63 J & W Electronics	109
83 KCS Electronics	138
48 Kikusui	25
44 L.I. Public Wholesalers	134
93 McIntosh Labs	94
66 MFJ Enterprises	104
— Micro-Mart Distributors	107
46 Microsignal	140
69 Multidyne Electronics	108
16 Multitech	29
— Netronics RD Ltd.	100
90 Network Sales	136
— NRI Schools	16-19
— NTS Schools	34-37
62 Optoelectronics	95
81 Paccom	114
51 Pacific One	108
31 Panavise	100
52 PAITA Electronica	110
70 Philips ECG	45

29 Philips-Tech Electronics	138
97 Pomona Electronics	27
30 Professional Video	124
— Radio-Electronics Reprint Bookstore	114
61 Radio Shack	115
79 Ramsey Electronics	125
17, 57 Random Access	109
56 RCA Distributor Special Projects Division	Cover 4
27 R.F. Electronics	124
32 Sams Books	26
109 Scientific Systems	136
25 SCR Electronics Center	118
55, 64 SEI	114, 120
82 Sintec	99
58 Solder Craft	138
23 Solid State Sales	118
43 Soltec	15
14 Sony	24
47 Spartan Electronics	140
— Symmetric Sound Systems	109
8 Tek-El	124
— Tektronix	5
108 Teltone	109
45 Trio-Kenwood Communications	33
78 Vector	44
89 Video Electronics	109
9 Video Guard	136
91 Viz Manufacturing	48
100 Wersi	106
13 Westech	139
— Zenith	11

Take stock in America.

## VIC-20

### VIC-20 INTERFACING BLUE BOOK

Did you know that your VIC can be used to control a 99c toy motor so effectively that it runs like a precision machine? Or that you can build an accurate digital thermometer using the VIC and four parts costing less than \$5?

These and other 28 interfacing projects selected for usefulness, ease of construction and low cost are detailed in the VIC-20 Interfacing Blue Book, a veritable gold mine of practical information on how to build a variety of interfaces for your computer.

Projects include: Connecting VIC to your stereo; Pickproof digital lock; Capacitance meter; Liquid level sensor; Telephone dialer; Voice output; 8K/16K RAM/ROM expansion; 128K RAM expansion; 8-bit precision D/A; 8-bit A/D converter; MX-80 interface and more. Written by a college professor in a friendly and informative style, the Blue Book gives you theory of operation, schematics, program listings, parts list, construction hints and sources of materials for each one of the 30 projects.

If you want to get the most out of your VIC this book is a must. Cost is \$14.95 (less than 50¢ per project!). Price includes postage.

microsignal Dept M  
P.O. BOX 22  
MILLWOOD NY 10548

VIC-20

CIRCLE 46 ON FREE INFORMATION CARD



# FOR FREE INFORMATION USE THESE POST-PAID CARDS

1

Print your name, address and Zip Code on one of the attached post-paid cards.

2

Circle the number (or numbers) on the card that corresponds to the number at the bottom of each advertisement or editorial item that you want information on. Advertisers' free-information numbers also appear in the ad index at the left on the facing page.

3

Mail the card. It's Postage-Paid.

## NOTE:

Use the postcard address for Free Product Information only. Address all editorial inquiries to Editor, RADIO-ELECTRONICS, 200 Park Avenue South, New York, N.Y. 10003.

## POSTAGE-PAID FREE INFORMATION CARD

Only one card per person

REA1283

	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151
	12	22	32	42	52	62	72	82	92	102	112	122	132	142	152
3	13	23	33	43	53	63	73	83	93	103	113	123	133	143	153
4	14	24	34	44	54	64	74	84	94	104	114	124	134	144	154
5	15	25	35	45	55	65	75	85	95	105	115	125	135	145	155
6	16	26	36	46	56	66	76	86	96	106	116	126	136	146	156
7	17	27	37	47	57	67	77	87	97	107	117	127	137	147	157
8	18	28	38	48	58	68	78	88	98	108	118	128	138	148	158
9	19	29	39	49	59	69	79	89	99	109	119	129	139	149	159
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160

2 ☐ Please send me 12 issues of RADIO-ELECTRONICS for \$14.97 and bill me. (Canada \$17.97—US Funds only)

NAME Please print \_\_\_\_\_

COMPANY NAME (if applicable) \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

**IMPORTANT**

VOID after February 29, 1984

Allow 6-8 weeks for delivery of first issue

## POSTAGE-PAID FREE INFORMATION CARD

Only one card per person

REA1283

	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151
	12	22	32	42	52	62	72	82	92	102	112	122	132	142	152
3	13	23	33	43	53	63	73	83	93	103	113	123	133	143	153
4	14	24	34	44	54	64	74	84	94	104	114	124	134	144	154
5	15	25	35	45	55	65	75	85	95	105	115	125	135	145	155
6	16	26	36	46	56	66	76	86	96	106	116	126	136	146	156
7	17	27	37	47	57	67	77	87	97	107	117	127	137	147	157
8	18	28	38	48	58	68	78	88	98	108	118	128	138	148	158
9	19	29	39	49	59	69	79	89	99	109	119	129	139	149	159
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160

2 ☐ Please send me 12 issues of RADIO-ELECTRONICS for \$14.97 and bill me. (Canada \$17.97—US Funds only)

NAME Please print \_\_\_\_\_

COMPANY NAME (if applicable) \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

**IMPORTANT**

VOID after February 29, 1984

Allow 6-8 weeks for delivery of first issue



NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

## BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 597 BOULDER, COLORADO

**Radio-Electronics®**

SUBSCRIPTION SERVICE

P.O. Box 2520

BOULDER, COLORADO 80321





NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

## BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 27346 PHILADELPHIA, PA.

POSTAGE WILL BE PAID BY ADDRESSEE

# Radio-Electronics®

FREE PRODUCT INFORMATION  
P.O. Box 13775  
PHILADELPHIA, PA. 19101



NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

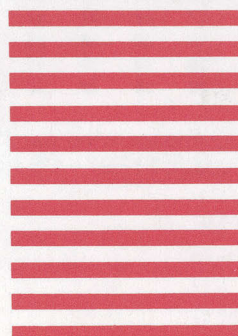
## BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 27346 PHILADELPHIA, PA.

POSTAGE WILL BE PAID BY ADDRESSEE

# Radio-Electronics®

FREE PRODUCT INFORMATION  
P.O. BOX 13775  
PHILADELPHIA PA. 19101



## RADIO-ELECTRONICS

4SM32

Subscribe today to the magazine that keeps you up-to-date with the newest ideas and innovations in electronics. (If you already are a subscriber, do a friend a favor and pass this subscription card along to him.)

### check offer preferred

- |   |   |
|---|---|
| <input type="checkbox"/> 1 Year—12 issues <b>ONLY \$14.97</b><br>(You save \$3.03 over newsstand) | <input type="checkbox"/> 2 Years ( <b>SAVE MORE</b> )—24 issues \$28.97<br>(You save \$7.03 over newsstand) |
| <input type="checkbox"/> Canada—12 issues \$17.97   | <input type="checkbox"/> Canada—24 issues \$34.97   |
| <input type="checkbox"/> All other countries—12 issues \$22.47                                    | <input type="checkbox"/> All other countries—24 issues \$43.97  |

- ☐ Payment enclosed    ☐ Bill Me    ☐ Check here if you are extending or renewing your subscription

Name (Please Print) \_\_\_\_\_

Company Name (If applicable) \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Allow 6-8 weeks for delivery of first issue

Offer valid in US \$ Only.

# For new ideas in electronics read Radio- Electronics

*During  
the next  
12  
months*

Radio-Electronics will carry up-to-the-minute articles on:

- hobby computers
- solid-state technology
- TV games • Video
- color TV • stereo
- test equipment
- radio
- radar detectors
- industrial electronics
- servicing
- TV-radio-stereo
- experimenter circuits
- exceptional construction projects

Don't take a chance on missing even one issue. Subscribe now and save!



## NEW IDEAS AND INNOVATIONS IN ELECTRONICS

The newest ideas and innovations in electronics appear in Radio-Electronics. Keep up-to-date!

**Subscribe Today!**



**Imagine that there was a single source for all your Interconnection needs.**

There is. A P PRODUCTS has the most complete line of Interconnection products and accessories. DIP, Socket and Card-Edge connectors, all styles and sizes of Headers, and D-Submin in both IDC and solder versions. A P PRODUCTS offers flat cable in both gray and rainbow, in a wide variety of widths. And, our new low cost IDC assembly tool can help put everything together without putting a crimp in your budget.

**Imagine that you could find high quality IDC products at affordable prices.**

You can. A P PRODUCTS understands your prototyping needs. Our IDC products are manufactured to give you the accurate, dependable connections you must

have. They are designed to save you time. And, they are priced to save you money.

**Imagine that there's an easy way to find the A P PRODUCTS you need.**

There is. The A P PRODUCTS Interconnection rack at your electronics dealer has the complete line of connectors, cable, tooling, and accessories. Over one hundred and sixty products in all. You'll be able to find what you need fast. So you can get back to your project in a hurry.



**Imagine that you need more information.**

No problem. Just call toll free 800-321-9668 for the name of the distributor nearest you. (In Ohio, call collect (216) 354-2101.)

# IMAGINE THAT



A P PRODUCTS INCORPORATED  
9450 Pineneedle Dr. • Box 540  
Mentor, Ohio 44061-0540  
[216] 354-2101  
TWX: 810-425-2250

In Europe, contact A P PRODUCTS  
GmbH • Baeumlesweg 21  
D-7031 Weil 1 • West Germany

CIRCLE 87 ON FREE INFORMATION CARD



# REACH\* FOR RELIABILITY



**RCA**

RCA Distributor and  
Special Products Division,  
Deptford, NJ 08096

CIRCLE 56 ON FREE INFORMATION CARD